SCIENTIFIC AMERICAN

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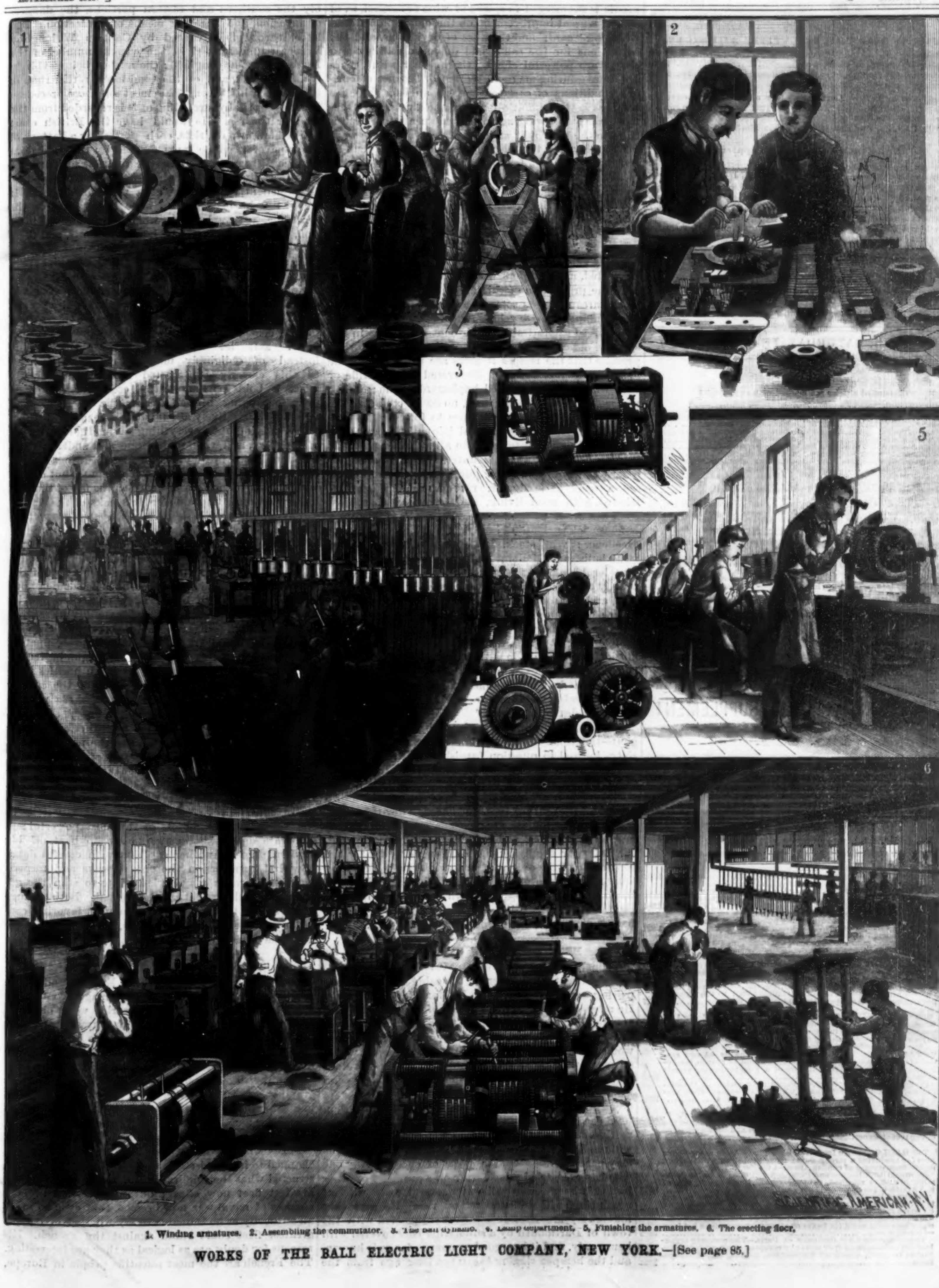

1. Winding armatures. 2. Assembling the commutator. 3. The Ball dynamo. 4. Lamp department. 5, Finishing the armatures. 6. The erecting floor,

WORKS OF THE BALL ELECTRIC LIGHT COMPANY, NEW YORK.—[See page 85.]

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A RUMOR ABOUT THE COMPASS.

The London *Electrician* has a dispatch from Berlin to the effect that a means has been discovered of using electricity for ascertaining the true north, instead of the magnetic needle; that, in short, the new means will be altogether superior to the compass, and is likely to supersede it.

If this is true it will be welcome news to the mariner, for since the coming of iron and steel ships the needle has played many fantastic tricks; requiring a fairly good knowledge of magnetism and other phenomena to understand it. The liquid or "Ritchie" compass, that came with the monitors, in which the needle is submerged in spirits of wine or alcohol, is, of course, a great improvement on the old-fashioned and wabbling "card;" and the lines of deviations, and the corrections for the same, laid down on all the ocean charts, are powerful aids to the mariner. But there are times—during magnetic storms or because of curious conditions of cargo—when, on an iron ship, the compass in the binnacle may say one thing, the "telltale" compass swinging in the cabin another, and a third in the tops still another—"pointing three ways for Sunday," as the phrase goes. Aboard a man-o'-war it is not so bad, for there they have plenty of technical talent. But the master of a merchantman is more likely to be a sailor than a scientist, and all he can do, if near the coast under such conditions, is to turn her head hard off.

"RECIPES FOR MAKING GOUT."

Under this title, an English society journal, having exhausted, and it infers without avail, its best advice as to the prevention of this dread malady, lays before its epicurean readers some specimen compounds peculiarly adapted to develop gout in those previously free and to excite its most virulent symptoms in the already afflicted. It has medical authority for its promise that the recipes it gives are really among the most exciting causes yet discovered in scientific or even what might be called haphazard cusine; taking no account of the lesser causes, no doubt crediting the gouty with sufficient intelligence to foresee the effect upon the metatarso-phalangeal joint of the great toe of the midnight lobster and the after-dinner port. It introduces a certain Dr. Hunter, whom it seems to regard as an authority on gout, and one can almost see a testy little doctor, rotund, red-faced, shortwinded, with good living, and knowing his subject from sensation as well as study, as he takes up a famous cookery manual and reads: "Giblet soup, par excellence: veal stock, lemons, yolk of egg, forced meat balls, and Madeira." This, he says, contains a considerable amount of gout and scurvy. Of an unusually rich mock-turtle soup, he says: "A dangerous dish, and will soon bring a man to his crutches." Another of the same he declares most diabolical—only fit for the Sunday dinner of a rustic who is to work the six following days in a ditch bottom; while of a third, mock-turtle soup made with beef, ham, giblets, lemon-peel, truffles, eggs, orange-juice, forced meat, and Madeira—a dish much admired by the patrons of a famous London restaurateur—the doctor says testily: "There is death in the pot."

It has often been observed of those afflicted with gout—the tone of the letters addressed to the society journal in question furnishes still another evidence of it—that they appear more concerned to discovering new remedies to lessen the pain when they shall be again attacked than in adopting a practical means for preventing its recurrence. They try colchicum, soothing topical applications, acetate of potash and other alkalies, and perhaps nitro-muriatic acid, the latter for supplying the oxygen necessary for the conversion of the excess of uric acid from which they are suffering into oxalic acid, and the latter into carbonic acid and urea—always with the hope, so it would seem, of accomplishing by chemistry what regular habits, air, and exercise would ordinarily yield.

HEMP VS. IRON IN OCEAN CABLES.

A timely and instructive letter it is that Judge R. L. Weatherbee, the manager of the cable companies' repairing service, sends to the Halifax (N. S.) *Chronicle*. He refers to the rapid impairment of ocean cables, and asserts that the cause of this is to be found undoubtedly in the use of iron, which rots away where hemp would stand. That is to say, the gutta-percha which enwraps the copper core should, to his way of thinking, have a serving of hemp alone instead of hemp and iron, as now. He says that down in those depths of ocean where the cables lie, there is not enough motion to part a gossamer thread; it is chemical action, not motion, that is to be feared—an action which hemp will readily withstand, but softening iron so that one may pare it as he would a piece of cheese. Any one who has ever tried a jack knife on a propeller or other iron that has been in salt water several years without repainting, will well understand this. He says that for eight years Halifax has been connected with the town of Dartmouth by a submarine core covered with hemp only, and it is as good as new, so far as is known, and the hempen rigging taken not long ago from the wreck of the Royal George, sunk in 1782, "is as perfect as when submerged."

How important this subject is may be understood from the fact that thirteen cables have been laid across the Atlantic at a cost of $75,000,000, which, so far, have cost $25,000,000 for repairs; 7,000 miles of this is, at this moment, lying abandoned because of unsubstantiality; the average life of a cable of the present construction having been estimated at twelve years.

MACHINE GUNS IN SHORE DEFENSE.

A discussion is now going on in the English press regarding the defenselessness of the British coast, notably the southern and eastern portions, the dangers of invasion, and the best means of protection. The latest theory is advanced by Captain Willoughby Verner, and described in the current number of the *National Review* (English); the author being evidently an artillerist, and of the land forces rather than of the marine; his theory, like most of those preceding it, sound or shaky, according as it is regarded from the land or the sea. He would have the British coast marked off into districts, each possessing a battery of the type of machine guns devised by that ingenious Yankee Hiram Maxim, and the districts so connected by telegraph that 32 of these pepper-boxes could be assembled at short notice at a threatened point. It would not be necessary to have heavy guns on the coast line, he says, because, where the intent was invasion, men would have to be landed in boats, and these he would open on as soon as in range.

He says that at many points of the coast ships could not come close in shore for the rocks, a statement abundantly supported by the soundings, as given on the admiralty charts; that it would require time to launch and man the boats, and still more to get them to the beach, thus affording time to prepare the defense. But let us suppose that the enemy, instead of obligingly making ready to fall into this cleverly constructed mouse trap, should select a bold portion of the coast for his enterprise, occupying himself during the day hours with making things lively about the shore, and, at short range, playing upon everything having the appearance of a battery, and when night came, and under cover of a hot enfilading fire, embarking his expeditionary force in boats armed not only with machine guns, but as well with shields to protect them from the fire of those in battery ashore. Captain Verner speaks of the American dynamite gun in high terms, and believes that, too, would prove useful on such occasions as those he would prepare for. Indeed, it would seem as if he might profitably make this his main reliance should the enemy come up within a mile and a half of the shore, but in case he did not, perhaps he could not put in the day hours to better advantage than by telegraphing for torpedo boats and carefully measuring distances and finding ranges to make them effective when night should set in, even if such preoccupation risked the completeness of the machine gun battery.

Admiral Porter and other high authorities have recorded the opinion that the result of the coming naval war, let it be between powers whose relative forces have heretofore been well defined, is likely to be uncertain, because of the introduction of war material of a novel description and the necessity for a complete change in tactics. Because of this change in conditions and the lack of data gathered from the operations of actual war, it is not easy to suggest a theory of attack or defense which does not contain a self-evident fallacy. One military authority tells us that shore batteries, unless of the most powerful and elaborate description, cannot hope to beat off big modern ships. Another explains with careful detail how that torpedoes in the channelways and torpedo boats in the roads may be looked to to stop the advance of anything that can be floated. Both arrange the details of their plans under the most favoring conditions, and each seems plausible, perhaps conclusive, until the other is examined.

NAVAL WARS OF THE FUTURE.

When the English heard of the Monitor and Merrimac fight, they realized that their magnificent steam war ships, the finest in the world, were obsolete. Hampton Roads signaled the appearance and prescribed the type of the ship that was to be; or, as the Admiral of the Navy, David D. Porter, says in his recent paper, whose title is quoted above, "the guns at Hampton Roads sounded the death knell to all these grand vessels" (the British fleet). For, if the Yankees had ships that could stand to the heaviest guns (then) known for more than three hours at close range without sinking, of what avail would oak be against them?

The "wooden walls" of Britain were thereupon changed to iron and steel, and little by little she constructed what the Admiral is inclined to regard as the greatest fleet now afloat; but so uncertain are the chances of naval war now become, that even so great an authority as he is unable to say whether or no this greatest fleet could stand against the French. His reasons for doubt are as logical as they are interesting. The French are the most scientific people in Europe,

he declares, and since now the machinist is become more important than the sailor, since even courage and seamanship will not avail against science, the question of supremacy on the high seas has, to his mind, apparently resolved itself into one of relative efficiency of material—which has the more destructive engines, which the means of most effectually working them. Before the advent of the French Jesuit and sailor, Paul l'Hoste, who wrote that famous work on naval tactics which, the Admiral says, has been made the foundation of all subsequent books on the subject, the French had no means of withstanding the terrible impact of the British advance. The British would lay their ships alongside, and the Frenchmen had no stomach for such fighting. L'Hoste showed them a way to successfully meet the shock. Instead of getting out of the way, the French fleet thereafter coolly waited for the enemy to come up, reserving its broadside for close quarters; raking him fore and aft, and then, while he was repairing damages, running down the wind and keeping away till he was ready once more to advance, when the maneuver was repeated. And so it was that though the Frenchman was invariably on the defensive, 'twere easier to beat him off than to capture him.

It is a curious fact, though the Admiral does not mention it, but any one can learn for himself by referring to American naval history, that it was this description of close fighting that brought the Yankee sailor to the front in the war of 1812. The Yankee captains invariably laid their ships alongside the enemy and boarded, reserving their fire until close up; and it was by their skill at this kind of work and their successes that a fleet so insignificant in point of numbers that, at the opening of the war, many wise men thought it should be destroyed to save capture, won great renown; a part, at times, showing itself along the English coast, to the great discomfort of the Liverpool merchants, who called the attention of parliament to the increasing boldness of the Yankee cruisers.

"France," says Admiral Porter, "has made great improvements. Perhaps the English are destined one day to encounter a foe that may snatch from them the laurels won since 1588, the year of the invincible Armada. Some future French admiral may avenge the humiliation inflicted on his country by Howe, Hyde Parker, Hood, Rodney, Collingwood, and Nelson."

Let us suppose that, in the days of these famous captains, there had been ships of steel and iron, the metal belting sometimes two feet thick, as now, and marine guns that, like those of to-day, could pierce any armor that it were possible to float! How then? Admiral Porter admits that, under such conditions, results might have been quite different. He says: "Had Nelson's ship (the Victory) been struck between wind and water by a 12 in. rifled shell, exploding on impact, as is generally the case, the ship would have had a hole torn into her side through which a good-sized whale might enter, and she would go to the bottom in five minutes."

Though early in his paper the Admiral declares that the result of a sea fight between English and French would be uncertain, he later on pays a deserved tribute to the naval discipline and bulldog tenacity of the British, and one may reasonably infer from what he says that when the call "To arms!" echoes along the English cliffs, our English cousins will be found equal to their occasions. He instances the affair of the Armada as illustrating what determination and, above all, discipline will accomplish, even against the greatest odds. Four years it had been in preparation, the English being in ignorance till, a few months before the blow was ready, they were apprised through the French king. Yet with so short a notice as this, with a fleet ludicrously inferior both as to number, armament, and size of ships, they literally tore it to pieces, the coasts being strewn with its wreckage, while the English suffered only a trifling loss.

The Admiral says that a sea fight to-day between modern ships might be like two undisciplined armies, mixed in confusion, dividing itself into hostile groups that should fall a-clubbing each other with the butts of their muskets.

More Mexican Ruins.

An interesting antiquity has recently been discovered at Palenque, in the Chiapas district of Mexico. The monument is situated upon the River Xhupa. Although it is now a complete ruin, it was originally a structure of considerable height, as three distinct stories are still distinguishable. The ground floor is very large, measuring some 120 ft. by 75 ft. The floor above is attained through holes in the ceiling or vault, and here a room is found measuring some 27 ft. by 9 ft. The openings referred to are natural and have been formed by the disintegration of the stone and the sinking in of the roof. On stone slabs set into the wall are bass-reliefs of human figures, warriors, etc. Although these stones are in a very bad state of preservation they are to be sent to the capital of Chiapas. Near this ruin are a row of houses forming a street, and not far from these the vestiges of a quite large town, all of course in a state of complete ruin.

The Screw Steamer Atrato.

The steel screw steamer Atrato, built by Messrs. R. Napier & Sons, Glasgow, for the Royal Mail Steam Packet Company, London, went on her official speed trials on the Firth of Clyde on December 13, 1888, when during four runs on the measured mile a mean speed of 17·20 knots was attained. This result was considered exceptionally satisfactory by Captain Bevis and Mr. Bowers, the company's representatives, the speed being one knot in excess of the guarantee. The vessel afterward proceeded on a six hours' run at full speed. This ship has been specially designed for the requirements of the company's Brazil and River Plate service, and has very fine lines, her appearance being enhanced by a clipper stem with figurehead. The general dimensions are: Length on load line, 400 ft.; breadth, extreme, 50 ft.; depth to spar deck, 33 ft. 4 in.; with a gross tonnage of 5,300 tons. There are staterooms for 200 first-class passengers. The dining saloon, which is seated for 100, is on the spar deck forward of the machinery. The fittings and decorations are in the Italian renaissance style, the walls being of polished walnut in panels, with balusters under the beams. From the saloon doors there is a double stairway, with carved teak balustrades, leading to the promenade deck, which is 200 ft. in length. At the head of the stairway is the music room, in bird's-eye maple and satinwood and dark peacock blue upholstery with gold silk tapestry. In the center there is a large well covered with a skylight of etched glass, which helps to light the dining saloon. Beside the music saloon is the ladies' boudoir, similarly treated. Aft on the promenade deck is the smoking room. A dining saloon, ladies' room, smoking saloon, and staterooms have been provided for 40 second-class passengers, while 400 third-class passengers can be accommodated. The machinery consists of triple-expansion engines of 6,000 horse power, steam being supplied by eight single-ended boilers, working to a pressure of 150 lb. per square inch. A complete installation of electric light has been supplied by Messrs. Siemens Brothers (limited), London. Refrigerating chambers of 10,000 cubic feet capacity are fitted on board. The cargo will be worked by hydraulic gear. The Atrato left on her first voyage on the 17th January. Messrs. Napier have in course of construction, in their yard, a sister ship to the Atrato.—*Engineering.*

Driving Boats by Water Jets, Air Propellers, and Gas Jets.

A correspondent of the *English Mechanic* says: The report on the trial of Thornycroft's torpedo boats was—In the screw boat the efficiencies are: Engine, 0·77; screw, 0·65; total, 0·5. In the hydraulic the efficiencies are: Engine, 0·77; jet, 0·71; pump, 0·46; total, 0·25. The jet as a propeller may be taken as a little better than the screw, but the loss in the pump is a dead loss, and represents about half of the power. In other words, before a hydraulic boat can be made to compare favorably with one driven by a screw, the pump producing the jet must work without loss.

The German experiment by employing the steam to act direct as a piston on the water shows the possibility of getting rid of both steam engine and pump by a sort of combination of both. For fair trial it should be tried in the same boat with the same power, and unless there are losses that it would be impossible to cure, it should certainly beat the screw. The above value of a water jet was of the particular one used. It does not follow that this is the most efficient one possible. At the discussion in the Royal Institution there was a great difference of opinion about the best kind.

Regarding the air propeller: The canal boat tried at Boston, being 62 feet long, with a bluff bow and stern, would not differ much in size from the torpedo boat; then as an 8 H. P. engine gave a speed of four knots, and the propelling power for greater speed increases as the cube of the velocity, we can easily compare the water jet and air propellers as used in the torpedo and canal boats. The question may be stated thus: The cube of 4 knots is 64, then as 8 H. P. is to 64, so is 170 H. P. to 1,360; the cube root of this is 11·1, which is the speed in knots that the canal boat would be propelled at by a Root's blower driven by an engine of 170 H. P.

Now, since this boat was propelled by a jet of air, it is equally certain that it could be driven by a jet of steam, so the engine and blower are quite unnecessary, and removing them would more than fulfill the conditions required in the official report for making the jet more effective than the screw.

From the preceding the question arises, Which will be more effective—air or steam? An examination of the possible work of the fuel and steam in a steamer consuming 240 tons of coal per day may give us some idea. Ten tons of coal, or 22,400 pounds per hour, will convert 224,000 pounds of water into about 6,048,000 cubic feet of steam at atmospheric pressure; this reduced one-sixth, or 1,008,000 cubic feet, shows the amount of steam available at 100 pounds pressure per square inch. This is about the utmost possible from the boiler for one hour's work.

The 22,400 pounds of coal will require 300 cubic feet of air for each pound, making 300×22,400, or 6,720,000 cubic feet of air. This, in passing through the furnace and mixing with the hot gases given off by the coal, will expand to at least five times the volume, or 33,600,000 cubic feet. This, compressed to one-sixth, or 5,600,000 cubic feet, will be about the amount available at 100 pounds pressure to the inch from the furnace, showing an available power of over five times the amount from the boiler.

If we suppose the immense funnels of such a steamer reduced to a suitable size (and placed fore and aft) to have this large volume of expanded air delivered through them at a high pressure, as a jet, we can realize the possibility of propulsion in this way. This shows that Mr. Secor's method of compressing air, rendering it inflammable, expanding it by explosion, and delivering it as a jet, was a correct one. This being the case, why was it a failure? In my opinion, the method had two serious faults. First, the discharge pipes were a long way too large. Four square feet of section to a discharge nozzle would be large enough for a 3,000 ton steamer. It matters not that the space the charge was discharged from was a small one. This may be seen by supposing a gun to have only the chamber for the powder of the usual size, and the remainder of the barrel from 100 to 200 times as large. This would be clearly inefficient. Second, the discharge under water was a mistake. This has been proved by experiment to be wrong, even with a water jet, which has nothing to condense, but in this case it would be delivering force from a heat generator at one end of a tube into a condenser at the other, and the only possible movement would be that due to the greater efficiency of one over the other. It seems surprising to me that Mr. Secor got any speed at all from his vessel, but I firmly believe he was working in the right direction, and that his experiment is the commencement of a new departure in ship propulsion.

Vancouver Water Works.

The city of Vancouver, B. C., is soon to have a high pressure water system, with a supply derived from the river Capilano, a precipitous stream taking its rise in the snow-capped mountains of the Coast Range of British Columbia.

A submerged water main, 1,100 feet in length, with flexible joints, has been laid across Burrard inlet, being part of the main line of the Vancouver water works.

The manner of laying and appliances were somewhat novel. A skidway of fir logs was built in a trench on the shore, reaching 1,200 feet back from the water's edge. The whole line of 1,100 feet was then made up on the skidway with the Ward flexible sockets. Three cables were then attached, one at each end and one at the middle, the forward and middle cables being carried across the stream and attached to the drums of separate engines. The cable from the rear end was attached to an engine drum at the water's edge, on the same side of the stream, and floats were provided for partially buoying the pipe, and lashed to it as it entered the water.

The weight of the whole length of pipe, including lead joints, was 55½ tons; the three engines having an aggregate of 130 horse power. With this arrangement the pipe was drawn steadily and safely to its place without accident, and was examined for its whole length by a diver, who cut the buoys loose. The pipe was tested and accepted by the city.

The successful accomplishment of this work is due to the local contractors of the water works, Messrs. Keefer & McGillivray, under the advisement of the resident engineer of the water works, Mr. Henry B. Smith, C.E.

Astronomical Notes.

THE CANALS OF MARS.

From forty careful drawings of this planet at the Lick Observatory in July and August, 1888, showing the details of the canals as seen through the great telescope, none has been seen *doubled*, as asserted and drawn by European observers of late years. The submerged continent had also reappeared in the great telescope in its former contour. Can it be possible that double sight or telescopic ghosts have been troubling the astronomers over the water?

SUN SPOTS.

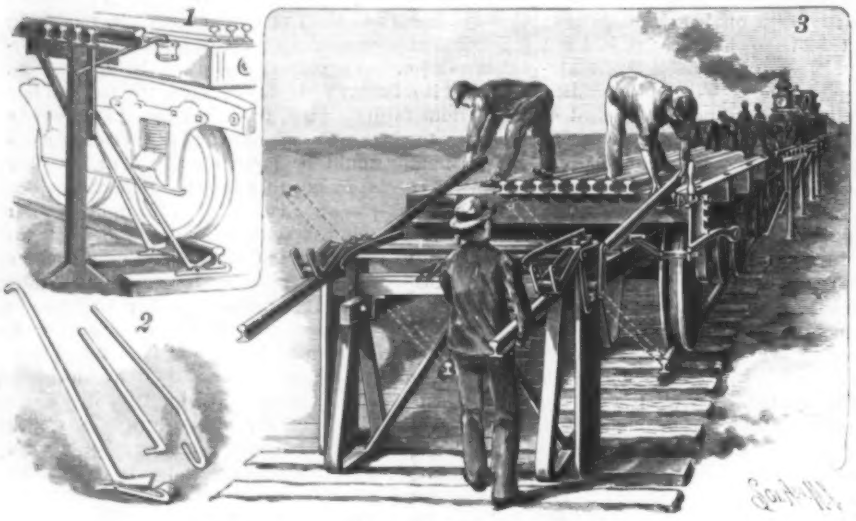
There were only two sun spots during November and December last, this being the year of sun spot minimum. What relation may this have to the unusually mild December and January?

National Exposition, U. S. of Colombia.

During February and March a national exposition will be held at Carthagena, U. S. of Colombia, and Mr. W. B. MacMaster, the U. S. consul at that port, offers his services to such American houses, not having representatives there, as desire to participate. It is stated that the commerce between that port and the United States has increased over 400 per cent during the last ten years.

AN IMPROVED TRACK LAYING APPARATUS.

An apparatus designed to lay rails to perfect gauge, with economy of time and labor, is illustrated herewith, and has been patented by Mr. Fredrick Herman, of Redfield, Dakota Territory. It consists of a rail-carrying car and rail placer, the car having double-flanged wheels which lap over both sides of the heads of the rails dropped from the placer, and hold them in perfect gauge until they are spiked to the ties. A transverse shaft is journaled on the car frame, to which a pair of brake shoes are eccentrically fixed to press against the laid rails, whereby one man may hold the car at rest until one pair of track rails is run on the placer and let down therefrom to the roadbed. Across the front of the car frame is bolted a metal bar from which the main longitudinal frame beams of the rail placer are hung by bolts or clevises, these beams having depending metal brackets or irons on and across which pieces of rails or other fittings may be carried. Two gauge plates hang vertically at each side of the placer head, having inbent head pieces lapping on the head plate, and held thereto by bolt ends formed at the upper ends of the two front and rear parts of the placer legs, which have foot plates adapted to support the placer head on the ties of the roadbed. The gauge plates and legs are separated in pairs at each side of the placer to form two vertical spaces to accommodate one pair of rails and hold them to proper gauge as they fall to the roadbed. By means of tripping rollers, levers, and latch bars, the rails being laid are readily placed with their back ends against the forward ends of the rails last laid, and on which the car rests, while the two pairs of guides direct them to their proper places on the ties and hold them to perfect gauge. For laying rails on curves of the track, the rail placer head may be swung to either the right or left hand as desired.



HERMAN'S TRACK LAYING APPARATUS.

The same inventor has designed an improved construction of jacks, shown in Fig. 1, to form a platform on which to unload rails from a flat car, to be reloaded on an iron car, to save labor and prevent bending of the rails, the skids used in connection therewith being shown in Fig. 2. These jacks are to be placed in position near each end of a car loaded with rails, the upright standing at the side of the roadbed and being made rigid by a brace made fast to the rail. The skids are then placed in position to make an inclined way down which the rails can readily be moved to the platform, to be thence reloaded upon an iron car, after the car from which they had been taken has been drawn out of the way.

Sulphite in Germany.

It is very curious that some of the German sulphite pulps are very high priced at the present moment. We have had several inquiries concerning the cause, and after communicating direct with some of the principal makers in Germany, we learn that the use of first class sulphite, of a very good fiber, is very much on the increase. German paper makers have given up the use of straw pulps almost entirely, and produce most of their papers from a mixture of sulphite and mechanical, the latter giving the filling and bulkiness, while sulphite supplies the fiber. This feature has so developed of late that there is a good sale for strong-fibered sulphite within the vicinity of most of the sulphite mills, and the makers are consequently not so anxious to export; in fact, some of them have now no surplus stock, owing to increased local demand. Those works which have surplus stock get it very often from the fact that German paper makers do not consider the make sufficiently strong, as they rely upon it to take the place of straw pulps and the softer grades of rags. Rags are being used less than ever in Germany, for paper makers find that it pays them very much better to use a good sulphite than go through the process of sorting and cutting rags, which have an inclination to be cheaper, and consequently even known brands are less reliable. This experience agrees with that of English paper-makers. Owing to the changes in textile manufacture, it is seldom that a pure linen or cotton is produced, and occasionally the sizing material used in textile manufacture is extremely injurious, including at times a solution of India rubber and equally objectionable material. It is evidence of common sense this German appreciation of sulphite fiber, especially when it is considered that it can be obtained in the form of half stuff, saving much expense in preparation.—*London Paper Trade Review.*

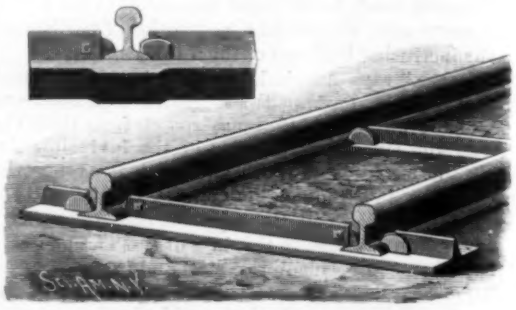
THE MACHINE GALLERY, PARIS EXHIBITION.

Our illustration gives some idea of the most important building on the Champ de Mars—the great machinery hall—which occupies nearly the whole width of the inclosure, and is parallel to the Ecole Militaire. It is 374 feet span and 1,378 feet long, and the roof is carried by 20 arched ribs jointed at the center and the bedplates. Outside these ribs, and running the whole length of the building, on each side, is an aisle with a gallery overhead that will be devoted to the exhibit of light machinery. The covering of this gallery will consist of a series of arches built at right angles to the longitudinal axis of the gallery. From the ridge down to the top of these arches the roof will be filled in with glass, and the covering and side of the aisles will also be glazed, so that the hall will be well illuminated. It is to be feared that the vastness of the building will dwarf its contents; certainly even the largest exhibit will look small compared with the dimensions of the roof.—*Engineering.*

THE MACHINE GALLERY, PARIS EXHIBITION.

AN IMPROVED METALLIC RAILROAD TIE.

A tie in which the rail can be easily placed or removed, and in which it will be firmly held to prevent spreading or canting, is shown in the accompanying illustration, and has been patented by Mr. Michael Maloney, roadmaster of the Scioto Valley Railway, of Ironton, Ohio. The tie is preferably made of rolled iron or Bessemer steel, and has a cross-shaped cross section, the horizontal flanges being adapted to rest on the track bed, while a downwardly extending flange is embedded in the roadway. In the upwardly extending flange are openings of a size to admit the bases of the rails, and immediately beneath them are offsets on the bottom flange to prevent a sidewise displacement of the tie. The rails are held in place by the heads of bolts passing through the top flange, the heads of the bolts having a straight bottom edge resting on the top of the horizontal flange, and a slightly beveled offset to fit on the top of the base of the rail, the inner face of the head resting against the side of the upper flange, in which position it is firmly held by a nut on the opposite side, while these fastening bolts may be readily removed and replaced.



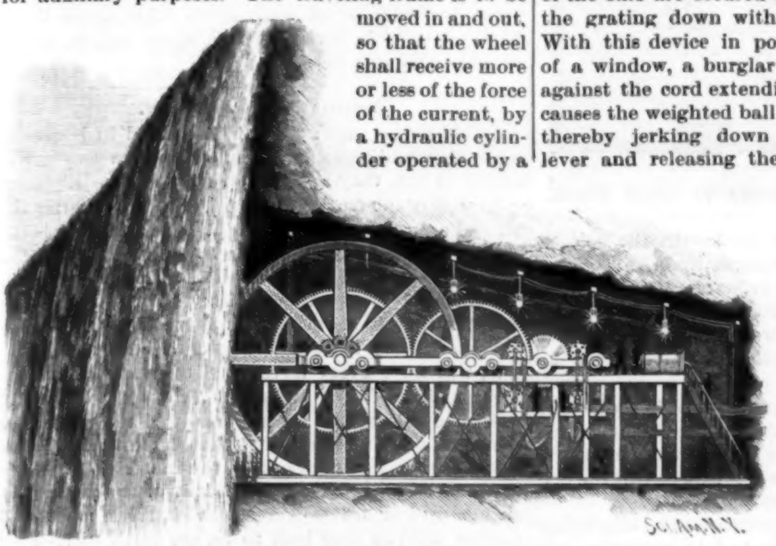
MALONEY'S RAILROAD TIE.

Metropolitan Telephone Co., New York.

Under the superintendence of Mr. J. A. Seely, the electrician of the Metropolitan Telephone Company, an extremely rapid removal of exchange apparatus was made on Sunday, December 30, 1888, when the company transferred eight hundred subscribers and over nine hundred and fifty wires from the John Street exchange to the new building in Cortlandt Street. The exchange room on the top floor of the fine Cortlandt Street building now has over 1,700 wires in operation, the Nassau Street exchange having been carried in there about November 1, with all its wires. The exchange room contains magnificent switch boards, for complete metallic circuits, built by the Western Electric Company, allowing of the operation of 5,000 subscribers' wires, and concentrating also Pearl, New, Beaver, and Fulton Streets exchanges, and distributing underground, and connecting by the trunk wires in the conduits with all the uptown exchanges. Mr. E. S. Sherwood, Superintendent of Exchanges, has this work in hand, assisted by Mr. Seely.

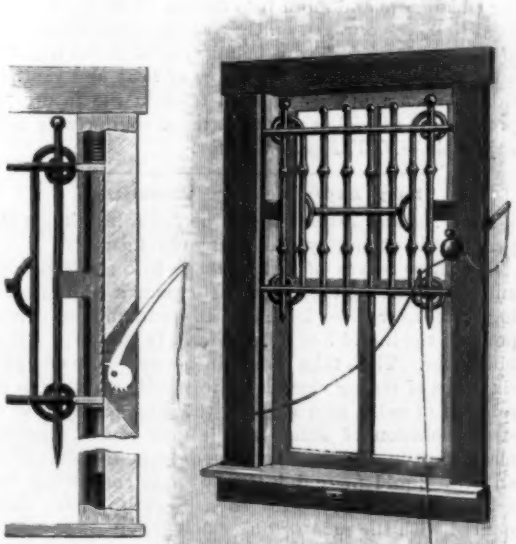
A NEW WATER POWER DEVELOPING DEVICE.

The device represented herewith for economically and efficiently developing natural water powers has been designed by Mr. M. Maginn, a mechanical engineer, of No. 2222 Wabash Avenue, Chicago, who suggests its advantageous use at Niagara Falls. The inventor proposes to excavate a cavity or drift under the falls, in front of which the flow of water will be continuous, making a recess in the rock some 30 feet wide and 65 feet high, and of sufficient depth to accommodate any desired machinery. In this recess is to be fixed, on permanent foundations, a stationary iron truss designed to carry a traveling frame sufficiently heavy to support an overshot steel water wheel of 60 feet diameter, with main driving shaft and spur gears, and intermediate shaft and connecting gears, with which are to be connected electric generators. It is designed to place upon the traveling frame four mammoth dynamos, of approximately 2,500 horse power each, and four similar dynamos upon a suspension frame directly underneath, one-half only of the whole number of dynamos being operated simultaneously, while the others are reserved for auxiliary purposes. The traveling frame is to be moved in and out, so that the wheel shall receive more or less of the force of the current, by a hydraulic cylinder operated by a steam force pump on the river bank, and arranged to automatically keep up the required pressure. The machinery is to have permanent inclosing walls, within which light will be furnished by electricity, the power being distributed to distant points by electric cables.


MAGINN'S DEVICE FOR UTILIZING WATER POWER.

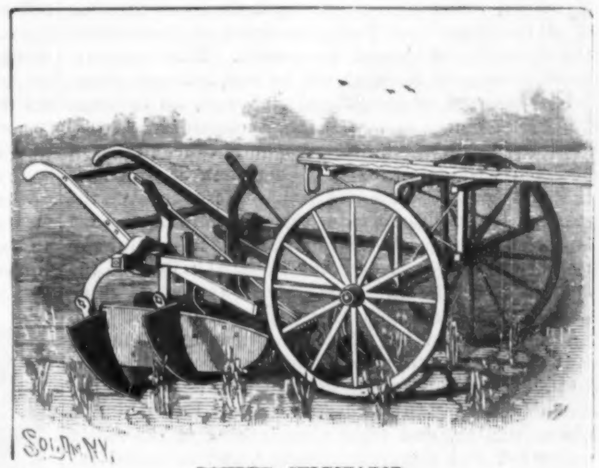
AN IMPROVED WINDOW BURGLAR GUARD.

The illustration herewith represents a device by means of which a person attempting to unlawfully enter a building through a window will be caught and held a prisoner. It has been patented by Mr. John B. Harris, of Eutaw, Ala. The inner face of the sides of the window frame are provided with grooved ways extending from top to bottom, in which are adapted to slide projections from a perpendicularly moving metallic grating, these projections being attached to vertically sliding bars, while the lower ends of the grating bars are formed with sharp points. To hold the grating in raised position when set for use, a lever with cam-shaped head is pivoted in a recess in the side of the window frame, as shown in the sectional view, the lever having a pin adapted to fit in one of a series of holes in the vertically sliding bar in the grooved ways in the side of the casing. The cam-shaped head also has teeth by which the grating may be locked in lowered position. A bracket is mounted at the window side, in the shape of a ring, over which fits another hinged ring having an arm, the latter ring being adapted to hold a weighted ball, connected by a cord with the lever holding the grating in raised position, a cord from the arm likewise leading across and being made secure upon the other side of the window frame. Beneath the window frame is a board mounted on springs, and serving as a step, a cord from this board being also fastened at its other end to the arm extending from the ring supporting the weighted ball. This board is hinged so that it may be folded up against the wall and secured by a button when not in use. In the bottom of each pocket of the grooved ways at the sides of the window frame are cushions for the vertically sliding bars to strike against when the grating falls, and to the upper ends of the bars are secured coiled springs to throw the grating down with force when released. With this device in position upon the inside of a window, a burglar entering, on pushing against the cord extending across the window, causes the weighted ball to drop off the inclined arm, thereby jerking down the arm of the cam-headed lever and releasing the pin holding up the grating, which is then thrown down by the compressed springs. Should the burglar observe the cord, and cut it, a similar result would follow upon his pressing his foot on the step just inside the window, the intruder being in either case impaled by the sharp points of the descending grating.


HARRIS' WINDOW BURGLAR GUARD.

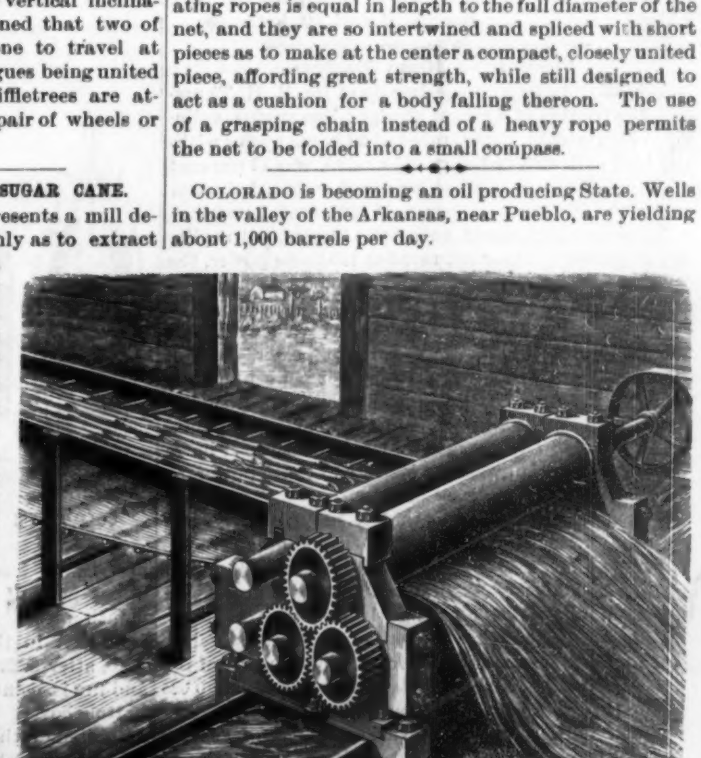
AN IMPROVED CULTIVATOR.

The accompanying illustration represents an improved cultivator which has been invented by Mr. Enoch Landes, of Reserve, Brown County, Kansas. It is designed specially for cultivating young corn, and is adapted to be used alone or in connection with a riding frame. It has an adjustable shield for protecting the plants, and the cultivator blades are adapted to break up the ground and clear away the weeds at each side of the rows, the blades and hoes being adjustable. The frame block from which the handles extend has on its inner end a downwardly extending arm, to which a cultivator blade is adjustably attached, while a rearwardly curved arm carries another detachably secured cultivator blade. To the inner face of this blade-carrying arm bars are secured which carry two or more forwardly curved hoes, the vertical adjustment of which is effected by a rod carried rearward and upward to a contact with the inclined face of an upper extension of the blade-carrying arm. From a perpendicular standard on the inside of the blade-carrying arm a shield is adjustably secured, adapted to travel upon the ground longitudinally of the implement between the rows to be cultivated, the attachment of the shield being such that it may be given any vertical inclination desired. In operation it is designed that two of these cultivators shall be employed, one to travel at each side of the row, the shafts or tongues being united to a transverse pole, to which the whiffletrees are attached, or directly to the axles of a pair of wheels or equivalent riding apparatus.


LANDES' CULTIVATOR.

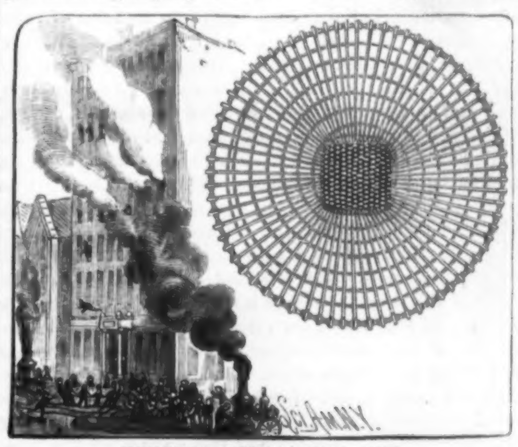
IMPROVED MILL FOR CRUSHING SUGAR CANE.

The accompanying illustration represents a mill designed to crush sugar cane so thoroughly as to extract all the juice therefrom, and furnish a dry bagasse. It has been patented by Mr. Charles Hughes of Matanzas, Cuba. The mill is made with five rollers, three being mounted alongside of each other in a horizontal plane, while the other two are placed above and inside the outer line of the lower rollers, the rollers being all geared together, so that a rotary motion imparted to one will be communicated to all. Adjustable turn plates are supported between the first and second and the second and third lower rollers, and there is one such plate centrally between the two top rollers, whereby the cane will be passed through, so as to be subjected four times to the pressure of the rollers, from its entrance at one side to its exit at the other. Each of the lower rollers has an annular flange to prevent the cane from leaving the roller sidewise, while a pan or other suitable receptacle is placed below to receive the juice pressed out of the cane. The shafts of the two outer lower rollers are mounted in sidewise adjustable boxes, but the shaft of the central roller is mounted in bearings which are adjustable sidewise and laterally, so as to regulate the relative distance between the several rollers with great accuracy. The adjustable bearing of the central roller consists of a box resting on a bottom plate supported on a wedge-shaped plate, through a groove of which pass set screws to raise or lower the box as desired, there being also vertically adjustable wedge-shaped plates on the sides of each box, with bolts and nuts to take up sidewise pressure.


HUGHES' CANE MILL.

AN IMPROVED LIFE-SAVING NET.

A net designed to be held beneath the windows of a burning building, so that the inmates in jumping or falling upon it will not be injured, is illustrated herewith, and has been patented by Mr. Malcom Hunter, of No. 32 Dutch Kill Street, Long Island City, N. Y. This net is preferably made about ten feet in diameter, of Russian bolt rope three-quarters of an inch in circumference, and with a three-sixteenths inch outside galvanized grasping chain, but has an approximately solid rope center piece, with ropes radiating therefrom to form the body proper of the net. Each of the radiating ropes is equal in length to the full diameter of the net, and they are so intertwined and spliced with short pieces as to make at the center a compact, closely united piece, affording great strength, while still designed to act as a cushion for a body falling thereon. The use of a grasping chain instead of a heavy rope permits the net to be folded into a small compass.


HUNTER'S LIFE-SAVING NET.

COLORADO is becoming an oil producing State. Wells in the valley of the Arkansas, near Pueblo, are yielding about 1,000 barrels per day.

Funeral Ceremonies in Paris.

In all countries death and the ceremonies of burial are sad and repulsive. In France, perhaps, decency is observed as well as in any country, thanks to the excellent organization of the Compagnie des Pompes Funebres, which forms, so to speak, the administration of all the churches in Paris, exercising on their behalf the monopoly of funeral ceremonies. This company, whose monopoly is regulated by law, is a vast enterprise, possessed of exceptional resources, an immense number of horses and carriages, a numerous and well disciplined personnel. Every year it takes charge of about fifty thousand funerals, about half of which are those of the poor. Thanks to this enterprise, even the poorest citizens are buried with some show of decency and in conformity with strict rules. The administration of the Pompes Funebres is situated in Paris in the Quaie d'Aubervilliers. It is a big, heavy, white stone building, built round a vast glass-roofed court yard. To the right and left of the entrance doors are the offices of the director and the bookkeeping department. In the court yards are the store rooms, the stables, the coach houses, and the harness rooms. Everything is black, somber, and silent; everything is rigorously numbered and ticketed, classified, and arranged for immediate use. The porteurs, or bearers, commonly called *croquemorts*, have a big room furnished with oak benches, where they assemble every morning, four hundred in number, to await orders—gloomy, serious, clad in various styles, some with blouses, but most of them in jackets. Over this room are other rooms with cupboards running down the middle in double rows. Each cupboard is numbered and fitted with a lock, the key of which the correspondingly numbered *croquemort* keeps. In these cupboards are kept the uniforms of the bearers, who dress before going out on service and undress when their service is over, only wearing their regulation costume while on duty. The masters of ceremonies have each a private room to dress in. Their uniform consists of a cocked hat, coat, knee breeches, silk stockings, buckled shoes, a court sword, and a wand. This personage is paid by the day, so much for each funeral. His duty is to arrange the procession in proper order, to fix the order of the precedence among the mourners, and to start the funeral.

Beneath the vast building of the Pompes Funebres are cellars dimly lighted with gas jets and full of rows and rows of coffins of all sizes and qualities. This cellar contains a stock of fifteen thousand coffins ready for use, varying in length from six feet two and one-half inches down to twenty-seven and one-half inches, which are the regulation maximum and minimum sizes of dead French humanity. For persons taller than six feet two and one-half inches a coffin has to be built on purpose, and to order. On one side of the cellar are the lead coffins, and in one corner a stock of square boxes in which coffins are packed for traveling by rail or steamer without attracting attention. Near the door of the cellar are some huge coffins, with a circumference of six to nine feet, destined for the accommodation of very obese corpses. Likewise near the door are thirty hand-carts of peculiar form, on two wheels, painted green and lined with black. These carts are used only when some terrible epidemic is decimating the population. The price of the coffins, of the inner lining, and of the covering pall, are all regulated by an immutable tariff. In 1870, during the siege, the little hand-carts, painted green and lined with black, had to serve universally as hearses, for all the horses had been killed for food.—*New York Mail and Express.*

Friction of Steam Engines.

According to recent experiments of Dr. R. H. Thurston, the friction of a Sweet straight line engine, cylinder 6 inches by 12 inches, rated at 20 horse power, without load and with ordinary slide valve, was 12 per cent of the rated power. When arranged with a balanced valve, the friction was 9 per cent of the rated power.

A Lansing high speed automatic engine, with cylinder 12 inches by 18 inches, rated at 100 horse power, the friction without load was found to be 8·88 per cent of the rated horse power.

A traction engine, locomotive type, with cylinder 7 inches by 10 inches, rated at 20 horse power, the friction without load was found to be 9·52 per cent of the rated horse power. In a condensing engine with cylinder 21 inches by 20 inches, being part of a compound engine, the low pressure cylinder indicating 71 horse power, the friction without load was 7 horse power, or 10 per cent of the indicated power.

In conclusion he remarks that it may be fairly conceded, after many years of engineering opinion to the contrary, that the friction of engines, loaded or not loaded, is nearly a constant, variable only with the condition of lubrication, and slightly only with great variations in speed. The friction of unbalanced valves was found to be about one-third of one per cent of the gross friction, and of the balanced valves about 0·025 of one per cent of gross friction.

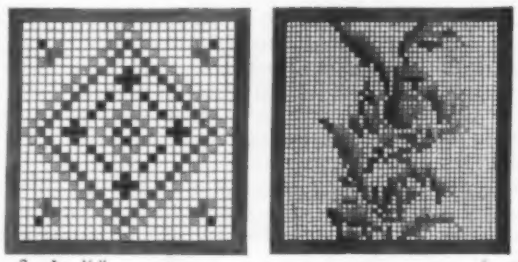
And finally that, in the various makes of engines tested, the maximum coefficient of friction may rise to 20 per cent of the indicated power, or fall to less than one per cent in the best engines.

METHOD OF PRODUCING DESIGNS ON WIRE CLOTH.

BY GEO. M. HOPKINS.

An experiment showing a phase of capillarity is illustrated by the annexed engravings. This experiment was originally intended for illustrating tapestry and other designs formed of small squares, in colors, upon the screen; but it has another practical application, which is capable of considerable expansion. For projection, a piece of brass wire cloth, of any desired mesh, say from 12 to 20 to the inch, is mounted in a metallic frame to adapt it to the slide holder of the lantern, and the wire cloth is coated lightly with lacquer and allowed to dry.

The slide thus prepared is placed in the lantern and focused. The required design may now be traced by means of a small camel's hair brush, colored inks or aqueous solutions of aniline dyes being used. The small



Sci. Am. N. Y.

METHOD OF PRODUCING DESIGNS ON WIRE CLOTH.

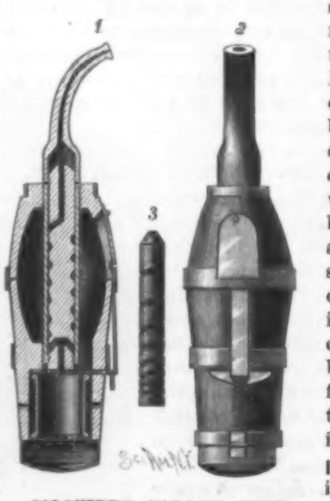
squares of the wire cloth are filled with the colored liquid, and show as colored squares upon the screen. Different colors may be placed in juxtaposition without liability to mixing, and a design traced without special care will appear regular, as the rectangular apertures of the wire cloth control the different parts of the design.

The colored liquid squares are retained in the meshes of the wire cloth by capillarity. A damp sponge will remove the color, so that the experiment may be repeated as often as desired. In this experiment the colored squares have the appearance of gems.

These designs may be made permanent by employing solutions of colored gelatine; but in this case the squares are so small that they are not very effective without magnification. Really elegant designs may be produced in this way for lamp shades, window and fire screens, signs, etc. The mesh of the wire cloth should be quite coarse, say 10 to the inch. The wire cloth is supported a short distance from a design drawn on paper, and the different colors are introduced into the meshes by means of an ordinary writing pen. The gelatine solution should not be very thick, and it must be kept warm. Ordinary transparent gelatine may be colored for this purpose by adding aniline. Colored lacquers answer admirably for filling the squares. The beauty of this kind of work and the simplicity of the method by which it is produced recommend it for many purposes.

AN IMPROVED TOBACCO SMOKING PIPE.

The accompanying illustration represents a pipe designed to prevent the nicotine and other unhealthy substances from entering the smoker's system. It has been patented by Mr. George F. Colquitt, of No. 906 Walker Street, Denison, Texas. The pipe has an oval shaped barrel surrounding the central tube, as shown in Fig. 1, for the storage of tobacco, the tobacco being introduced by an outside door, shown in Fig. 2, while immediately beneath this door is a gate, closed by a spring bar, by means of which the tobacco is admitted to the combustion chamber below, having a perforated bottom. A tube is held centrally in the barrel, the pipe stem being held in this tube, a spiral groove being cut on the stem, as shown in Fig. 3, leading to a central aperture in the upper part of the stem, opening at the top into the mouth piece. The tobacco in the barrel is separated from that in the combustion chamber by the spring gate, after sufficient has been allowed to pass down, and fire is communicated through an opening in the bottom cover. In smoking, the nicotine will be mainly deposited on the conical end of the plug in the lower part of the central tube, while the smoke travels a long distance around the spiral groove before it reaches the smoker's mouth.



COLQUITT'S TOBACCO PIPE.

The Sacredness of Seven.

A writer in the *Agricultural Implement* has been studying over the mystical number seven, and concludes that it is undoubtedly the sacred number. There are seven days of creation; after seven days' respite the flood came; the years of famine and plenty were in cycles of seven; every seventh day was a Sabbath, every seventh year is the Sabbath of rest; after each seven times seven years came the jubilee; the feasts of unleavened bread and the tabernacles were observed seven days; the golden candlestick had seven branches; seven priests with seven trumpets surrounded Jericho seven times and seven times the seventh day; Jacob obtained his wives by servitudes of seven years; Samson kept his nuptials seven days, and on the seventh day he put a riddle to his wife, and he was bound with seven green withes and seven locks of his hair were shaved off; Nebuchadnezzar was seven years a beast; Shadrach and his two companions were cast into a furnace heated seven times more than it was wont. In the New Testament nearly everything occurs by sevens, and at the end of the sacred volume we read of seven churches, seven candlesticks, seven spirits, seven trumpets, seven seals, seven stars, seven thunders, seven vials, seven plagues, seven angels, and a seven-headed monster.

Ventilating Our Homes.

An old writer says: "When men lived in houses of reeds, they had constitutions of oak; when they live in houses of oak, they have constitutions of reeds."

Evidently the truth inculcated is that the better the air and more bountiful its supply, the healthier is the inmate of a house, be it palace or cottage. Too often the very wealth of a house builder militates against his splendid mansion becoming that ideal home of comfort that it should be, and the inmate of some wretched, leaky little hovel, perched on a rocky hillside, will have every advantage over such a one as regards vigor of body and elasticity of spirits.

Science tells us that there is a needed respiration for the walls of our houses, and that, fortunately for us, whether conscious of it or not, the materials of which our modern houses are made admit of the passage of air in a greater or less degree. Brick, stone, wood, and mortar, solid as they look to us, are easily pierced by that volatile fluid which we call air.

Such is the elasticity of air that, fortunately for us, a slight force only is needed to put and keep it in motion. The difference of 20° Fahrenheit in temperature between outdoor air and indoor air will cause the passage of about eight cubic feet of air each hour through every square yard of wall surface made of brick. A plastered wall also admits of the free passage of air, and actually serves as an efficient filter by arresting the progress of dust or any of those particles—often injurious—with which the atmosphere is laden.

Heat is the great motor for ventilation, whether natural or artificial, and the great problem in winter is to introduce a sufficient quantity of pure warmed air to make one's room comfortable without attendant draughts that shall imperil the health of their occupants.

Open fireplaces, whether the fuel consumed in them be wood or coal, are among the very best ventilators that we have, and yet the question of expense is bringing them more and more into disuse. But there is no need to be discouraged on that score, because the eyes of all practical people are being opened to the importance of combining the twin forces of heat and ventilation in such a manner as shall tend, in the future, to prolong life as well as render it more comfortable and enjoyable.—*N. Y. Fashion Bazar.*

Easy Experiment in Chemistry.

The *Practical Teacher* gives the following simple experiment in chemistry, which any child can try:

Cut three leaves of red cabbage into small pieces, and, after placing them in a basin, pour a pint of boiling water over them, letting them stand an hour; then pour off the liquid into a decanter. It will be of a fine blue color. Then take four wineglasses—into one put six drops of strong vinegar; into another, six drops of solution of soda; into a third, the same quantity of a strong solution of alum; and let the fourth glass remain empty. Fill up the glasses from the decanter, and the liquid poured into the glass containing the acid will quickly change to a beautiful red; that poured with the soda will be a fine green; that poured in with the alum will turn to a pretty purple; while that poured into the empty glass will remain unchanged.

Underpinning of Houses.

The walls under houses and barn basements, if they have been built several years, always need some attention on the approach of winter. Our climate, so moist in fall and so cold in winter, makes sad havoc with walls. Mortar being largely composed of lime readily absorbs dampness, and freezing when moist disintegrates it. A little fresh mortar and a few hours' work with the trowel will save the ingress of much cold every winter.

THE BALL ELECTRIC LIGHT SYSTEM.

When it is shown that a machine performs its work with two-thirds the power required for driving other machines of the same class and the same nominal capacity, and when it is demonstrated that the machine does this without destructive wear or other ill effects, it becomes an interesting question as to how the superior results are obtained; and if the machine be constructed with almost entire disregard for accepted principles, the matter becomes still more interesting, and is naturally referred to experts for explanation; and when experts who are governed by accepted principles are obliged to say that "it is a good and efficient machine constructed on bad and inoperative principles," we have an anomaly which needs explanation.

This is about the scientific status of the Ball dynamo electric machine, which we illustrate. Its practical and commercial standing show in a remarkable way that accepted scientific principles are not always reliable as the basis of business operations, and that theory is sometimes unsupported in practice. The Ball dynamo was at first called an unipolar machine, which, according to the common understanding of the term, is incorrect. It was not, however, so named by its inventor; but wherever it has appeared in the literature of the subject, it is known as the Ball unipolar dynamo.

By referring to the engraving, it will be seen that the field magnet of this dynamo consists of four cylindrical bars of soft wrought iron, arranged in two pairs connected with yokes or end pieces, which also form the support of the armature shaft. To these bars are secured curved pole pieces, which partly encircle the armatures, one pole piece being attached to each pair. Upon the armature shaft are mounted two Gramme armatures, one arranged to revolve in proximity to the upper pole piece, the other being similarly arranged with reference to the lower pole piece. The pole pieces are diagonally opposite each other, there being but one for each armature. It will be noticed that the bars forming the field magnets are of unusually small diameter, and that the winding of the field magnet is apparently somewhat out of balance.

The two armatures, which are independent of each other, are each provided with a commutator. The positive brush of one commutator is connected with the outgoing conductor, and the negative brush of the other commutator is connected with the return conductor. The remaining brushes of the two commutators are connected to the terminals of the field circuit. The armature shaft has a central bearing, and upon one of its extremities outside of the yoke of the magnet is arranged a pulley, which is preferably of the same diameter as the armatures. A noticeable feature of this dynamo is that its armature is driven by a belt which is comparatively very narrow.

The commutators of this machine are substantially made of bars of pure copper, with intervening sheets of mica, the whole being clamped together by heavy bronze clamps, forming a practically solid cylinder, with an arm extending from each bar to the periphery of the armature, to receive the ends of the conductors, forming the armature sections.

The armature ring, which is of the Gramme type, is supported by adjustable spiders, which permit of great accuracy in the adjustment of the ring, and also of perfect balancing, so that the dynamo runs steadily and without jarring. The armature rings are constructed according to a method which yields an armature which is almost as solid as if it were of homogeneous metal throughout. The winding is thoroughly soaked with insulating material, so that all of the covering of the wire is thoroughly saturated, and the insulation is baked on by heating the conductor by means of a current from a large dynamo. After the insulation becomes dry, the ring is provided with a protecting covering of tape, and is surrounded by bands of steel wire, for retaining the conductor of the armature against pressure due to centrifugal action.

These dynamos are made for both arc and incandescent lighting. There are five sizes, and of each size there are machines of four different windings, thereby virtually furnishing twenty different machines. The journal boxes of the armature shaft are made of fine, hard bronze, which shows no appreciable wear after years of use.

A complete Ball system includes, besides a dynamo, an arc lamp of novel construction and an incandescent lamp. The arc lamp is provided with a rack bar for holding the positive carbon, which is moved by gravity under control of a peculiar escapement, the escapement being let off or retained by an armature acted upon by series and shunt solenoids. No dash pots are required in the construction of this lamp, as there are no sudden movements, except that required to form the arc when the current is turned on. The light is white and uniform, and the lamp and dynamo are so arranged in relation to each other that a considerable variation of speed produces no effect in the light, and does not result in wasting the current in the production of heat in the armature. This feature is of great importance, as it permits of placing the dynamo in factories, and driving it by the power employed for running other machinery.

The Ball company claim that with their system it only requires three-quarters of one horse power for each full arc light of 2,000 nominal candle-power, and that the dynamo requires but two-thirds of the power used in driving other dynamos. In the Ball dynamo, if one armature is disabled, the other armature will maintain nearly three-quarters of the full number of lights, thus rendering the dynamo equivalent to two ordinary dynamos.

This enterprising company has recently perfected a new dynamo and a new system for operating small subdivided arc lights of 800 nominal candle power each. These lights are produced on less than one-third of a horse power each, thus securing great economy, besides producing a light which overcomes the objections raised against arc lights of larger power, the light being diffused and the shadows being modified, so that the illumination, while very strong, partakes more of the nature of gaslight.

In Fig. 1 of the illustrations is shown the operation of winding the cores of the armatures. The core being the foundation of the armature requires careful manipulation, as a space between the convolutions of the wire would be an element of weakness. After the winding of the core it is carefully wrapped with tape, when the conductor is applied in sections. It is advantageous in the construction of the dynamo to provide as many sections of the conductor as possible. In the larger machines of this class there are as many as 360 divisions of the armature and commutator.

In Fig. 2 is illustrated the method of arranging the commutator bars with the mica insulation. Fig. 3 shows the Ball dynamo, which has already been described. In Fig. 5 is shown the operation of wrapping the armatures, connecting the commutator bars with the conductor, and applying the steel bands. In the foreground of this picture are shown two finished armatures, one showing the commutator end, the other exhibiting the spider upon which the ring is mounted. In the assembling shop (shown in Fig. 6) all the parts of the dynamo are brought together and adjusted one to another, and tested. Fig. 4 shows the lamp department, the construction being carried on in the farther part of the room, the lamps being adjusted and tested in the part represented in the foreground. In this view are also shown several lamps, both plain and ornamental.

The numerous testimonials which we have examined are unanimous in according to the Ball system great economy. They also express satisfaction in regard to the quality and steadiness of the light. In the list of Ball electric light plants which have been established, we notice many familiar names of large establishments scattered all over the United States and Canada, which are using these dynamos and lamps. In many cases the plant has been increased, thus showing due appreciation of the system.

Saccharine Prohibited in France.

The following is an abstract of the preamble of the bill now before the French chamber prohibiting the importation of saccharine into France: "The attention of the administration has been directed to a new coal tar product known as saccharine. This substance, which differs essentially in its elementary composition from vegetal sugars, possesses much greater sweetening power, a quality that was sure to lead to its being used as a substitute for sugar in many cases. We learned from our consular agencies abroad that factories were being established in certain countries for the purpose of bringing saccharine into competition with beet and cane sugar, not only in France, but also in other neighboring markets. The high cost of that substance seemed to constitute an insuperable obstacle to its general adoption, but lately the situation has changed. It can now be more cheaply produced, and already it is extensively used, mixed with glucose, in the preparation of jams, sirups, and liqueurs. It has, therefore, become an urgent necessity to provide a remedy for the evil, in the interests of the customs receipts and that of the health of the consumer; for it has been shown by the report of Drs. Brouardel, Pouchet, and Ogier, in the name of the consulting committee of hygiene, that saccharine, and the various preparations derived from it, are noxious to health, and ought to be prohibited. Wherefore the government has deemed it expedient to prohibit the importation of saccharine and saccharined substances."

Cement for Belts.

Wade's Fiber and Fabric made the above inquiry, and has published a number of replies. The following is as good an answer as we have noticed: I will tell, he says, what I use, but do not say it is the best, but gives good satisfaction in my case. When I put on a new belt I generally sew it with lacing, and run it for a few days to get the stretch out. Then some Saturday afternoon, when the machinery is stopped, I cut my belt and skive down so as to have about six inches lap of the same thickness, then I put on a thin coat of Le Page's prepared carriage glue, and put in two lacings lengthways, press with heavy weights, and let stand till Monday.

Peruvian Railways.

At a recent meeting of the Civil and Mechanical Engineers' Society, at the Westminster Palace Hotel, a paper was read on the "Oroya Railway, Peru," by Mr. W. Alfred Eckersley. The author, in commencing, chiefly alluded to recent Peruvian history, and the way in which during unnatural inflation money was borrowed in the most reckless manner for railways and other public works, which were only half executed when such a series of national reverses and disasters ensued as to almost paralyze the commerce and trade of the country. The natural resources of Peru, however, are so great that the author expressed the greatest confidence in the future prosperity of that country.

Proceeding to describe the railway, he stated that the line was now open to Chicla, a distance of 87 miles from Callao, but until completed to Oroya, a further distance of 50 miles, the object of the line and development of the rich mineral and productive districts of the interior would not be accomplished. The present terminus is over 12,000 ft. above sea level, and is gained by an uninterrupted series of ascending gradients, the steepest being 1 in 25. The sharpest curve allowed is 6 chains radius, but in several places single and double back shunts have been found necessary. The River Rimac and numerous gorges are crossed by viaducts of the American pin truss description, the spans varying from 91 ft. to 205 ft., and resting upon lofty, spidery-looking iron piers, sometimes over 250 ft. high, and the author seemed much impressed with the suitability of this description of iron work for such work, and considered it far superior to riveted structures. In making the surveys for the line, and also in constructing the viaducts, men and materials were slung along ropes across the lofty chasms, and much courage and energy must have been displayed, one of the largest of these grand examples of engineering skill having been erected in four months. The author tested the viaducts with heavy rolling and stationary loads, and found them to be very satisfactory, the deflection at center being generally less than 1 in 2,000, and the recovery perfect.

Insurance Restrictions on Oil Fuel.

The Hartford Insurance Company has laid down the following strict rules in regard to the use of crude petroleum as a fuel:

1. No storage of crude petroleum for fuel shall be allowed in any position where, in case of accident, it can flow toward the insured premises, or within less than 50 ft. if wholly under ground, or 100 ft. if wholly or in part above ground. This excludes all storage in boiler rooms, or adjacent to premises, or feeding from oil cars.

2. Delivering of oil to furnaces must be by suction or other process, whether by pump, vacuum, or any other appliance that will accomplish the end sought, the supply to be lower than the furnace, so that, when not being used, the flow shall be away from, and not toward, the premises. This prohibits the feeding of oil by gravity pressure or by other means from a storage supply higher than the premises.

Where the foregoing conditions are fully complied with, and storage tank, if wholly under ground, is 100 ft. or more from risk, or if wholly or in part above ground is 200 ft. and upward distant, permission to use oil for fuel will be granted without extra charge. If storage tanks are located less than 100 ft. and not less than 50 ft. of risk, wholly under ground, or from 100 ft. to 200 ft. if wholly or in part above ground, the extra charge will not be less than twenty-five cents.

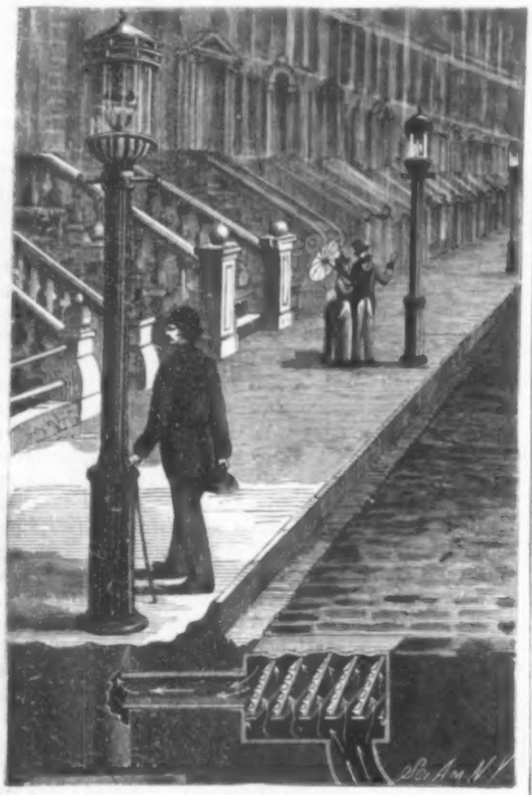
To Precipitate Gold.

The gold from galvanic baths is easiest precipitated with the galvanic current upon a smooth copper plate. The gold which does not precipitate as a powder is then scraped off and purified, as well as that which precipitated as powder. Impure gold, which chiefly consists of gold, however, is dissolved in the indicated proportions in the *aqua regia*; it is then evaporated to one-half, diluted with water, filtered, and washed out with large quantities of water. This washing is continued until the escaping fluid is clear water, and no longer colored by sulphate of iron. Meanwhile a solution of handsome crystallized sulphate of iron has been prepared as follows: To 10 grammes (6 dwts. 10·32 grains) sulphate of iron, 100 grammes (3 oz. 4 dwts. 7·2 grains) water add 10 grammes muriatic acid. For precipitating the gold suffices the 4½-fold quantity of crystallized green copperas of the impure gold used. In order to precipitate the gold, pour its solution into the copperas solution. The gold will very quickly fall down in this diluted fluid. Decant the clear liquid, and first wash with water acidulated with muriatic acid, afterward simply pure water. Collect the gold in a porcelain dish, drain off the wash water as closely as possible, and let it dry in a moderately warm place.—*National Jewellers' Journal.*

BE very particular about disinfecting the kitchen sink. Washing soda, two tablespoonfuls to a gallon of boiling water, makes an excellent wash to pour hot into the sink at night after you have finished using it.

AN IMPROVED SEWER VENTILATOR.

The illustration herewith represents a construction combining a tubular lamp post, pillar, or standard with a disinfecting chamber, the latter having connection with a sewer pipe, whereby the gases will be thoroughly disinfected and carried off, or passed through a lamp or gas flame and consumed. This invention has been patented by Mr. Thomas P. Worthington, of Southshore, Blackpool, Lancaster County, England. Beneath the level of the pavement is placed a box with detachable lid, the box being connected by a pipe from



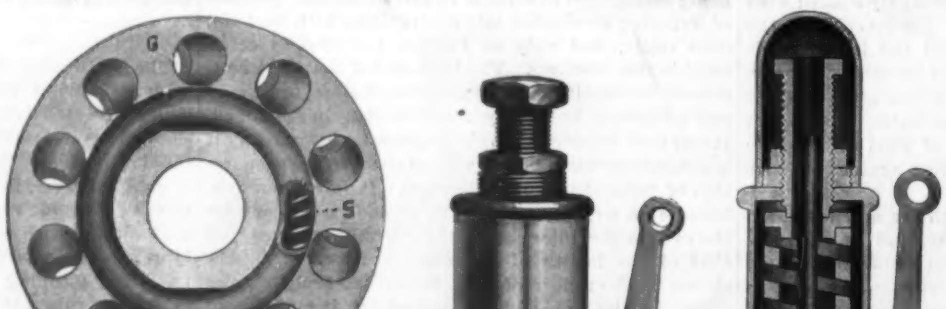
WORTHINGTON'S SEWER VENTILATOR.

one end with the hollow lamp post, while a connection from a sewer pipe enters the bottom of the box at its other end. Within the box is a horizontal perforated partition, above which is held a series of perforated grates having inclined ledges, forming pans to hold either liquid or solid disinfectants in such position that the sewer air passing through the box will come in contact therewith. In the center of the lamp top or cap is a conductor, consisting of a downwardly projecting tube with mouth immediately over the flame orifice, adapted to burn the air and gas in passing, while over the top of the lamp is a series of deflecting plates, the center plates having a central aperture aligning with the conductor. The bottom of the lamp is preferably closed, except at a point immediately above the post and at one side of the center. For further information relative to this invention, address Mr. Thos. Poole, No. 210 Jennie Street, Trenton, N. J.

THE AMERICAN PATENT POP SAFETY VALVE.

This well known valve is manufactured by the American Steam Gauge Company, of Boston, Mass., and has for years been recognized as one of the best devices of its kind on the market. It possesses some peculiar features, which are shown in the accompanying illustrations, and is the *only* double-headed safety valve provided with a second or movable head on the top of the valve proper, as shown in Fig. 1, in which G represents an adjustable automatic head on top of valve; H, the valve; J, inclined holes in automatic head; S, spring to return head to its position after valve has stopped blowing; P, cavity for the accumulation of steam to feed holes through valve and head. There are two series of holes drilled around the outer edge of the heads for the purpose of reducing the amount of increased area; the first of the series being around the head of the valve proper, and drilled at an angle of ninety degrees with the seat of the same, and the second series being around the second or movable head, and drilled at an angle of fifty-five degrees with the holes in the head of the valve proper. When the valve lifts from the seat to blow, the steam passes through the holes in the head of the valve proper into the corresponding holes in the second or movable head, which will be forced around in such a manner that the holes of the two heads will be directly in line with each other.

Among other advantages possessed by this valve, it may be claimed to be entirely automatic. It will always blow off at the point of pressure at which it is set, and close with very little reduction of pressure. Its construction and principle of action are such that it will not stick on its seat. The spiral action of the steam, after passing through the inclined holes, causes the valve to rotate in its casing, which keeps the casing always clean about the edges of the valve, and also, by the rotary motion, the valve never seats twice in the same place.



THE AMERICAN PATENT POP SAFETY VALVE.

Rufus Cook's Good Advice.

Rufus Cook, a civil and sanitary engineer, has addressed an open letter to the city council of Minneapolis, in which he makes some pertinent and valuable suggestions on the subject of city sanitation. He states that with the growth of cities there is a constant tendency to the accumulation of unsanitary conditions. Sanitary work consists in the application of preventive measures rather than curative, the latter being the province of the physician. To insure this sanitary work being fully carried out, ample funds should be appropriated to the health department. People need to be taught that what they eat, drink, and breathe has an important relation to their health and happiness, and to maintain human existence in its highest state requires pure air, pure water, and pure food, and these supplemented by a pure soil. As purity of air is first in importance, the best system of heating and ventilation should be applied to all public and private buildings. A good plumbing law is one of the most effective steps in sanitary progress that the city can possibly have. Mr. Cook quotes from the New Jersey Board of Health: "Most of our cities are still far behind in the details of approved sanitary administration, and in those financial provisions, therefore, which are necessary for the health of the people. In the work of sanitary inspection and advice, and in the general oversight of the health of the people, we find a field of operation which might be largely extended to the great advantage of our citizens."—*The Sanitary News.*

A Horse Killed by Electricity.

By the wind and snow of January 20, many wires in this city were disturbed and torn from the poles. On the morning after the storm a milkman drove his horse up to a trough at West and Leroy Streets, to water the animal. He paid no attention to some dangling telegraph wires, which, as the animal approached the trough and lowered its head to drink, came in contact with it, and became entangled about its legs. The wires were in communication with an electric light lead. The horse was thrown to the ground and at once died from the electric shock. This occurrence emphasizes the danger to life from the overhead electric lines, and indicates the importance of placing them under the surface. A horse was used in the recent experiments at Edison's laboratory to show how the electric current could be applied to the infliction of the death penalty for capital offenses. In this latter instance the danger of overhead wires and their power to inflict accidental death were shown by the same illustration.

AN INDICATOR ATTACHMENT FOR PASSENGER ELEVATORS.

A simply constructed device whereby the approach of an elevator from below or above will be shown, and whether the car is going up or down, is illustrated herewith, and has been patented by Mr. Oliver C. Hayward. The several indicators are pivoted within the elevator shaft, or a casing auxiliary thereto, at a suitable distance above the flooring of each story, and consist of a double series of angle indicating blocks, one series having a friction roller upon its inner end adapted to engage the car, and a lever connecting the two series, while the outer member of each series has produced thereon the words "down" and "up." The elevator car has a strip secured to its front or side adapted

HAYWARD'S INDICATOR FOR PASSENGER ELEVATORS.

to engage the levers and blocks, in such way that, as soon as the elevator leaves a floor, ascending, the indicator "up," on the floor above, shows that the elevator is going up, and remains in this position until the elevator starts for the floor next above. This enables one in the passage or hallway to see when an elevator is there, and which way it is to go, while on the downward trip the indicator "down" operates in like manner. This device has already been adopted and may be seen in operation at the New York Produce Exchange. For further information relative thereto address Mr. O. C. Hayward, P. O. Box No. 3699, New York City.

American Railways in Chili.

Speaking of the construction of railways in Chili out of revenue resources, the London *Statist* remarks that: "There appears to have been some misconception among English contractors for railway work, who have imagined that any work done would be paid for in Chilian bonds, which under the state of tension between the Stock Exchange committee and the Chilian government would preclude the probability of the bonds receiving an official quotation. Be this as it may, we regret to notice from Chilian advices that orders for railway material have been given to American firms, so that really the agitation in Stock Exchange quarters against Chili has been detrimental to English interests. The contracts for the building of Chilian railroads have been signed between the representative of the American company, Mr. Lord, and the Chilian government, and the contracts have received the official sanction of both houses of Congress. The amount to be expended is about four millions sterling. This extension of American enterprise may mean the virtual extinction of English railroad construction in Chili in the future. To the present the rolling stock and the rails for the Chilian railway system have been chiefly supplied from England. Once the Americans get themselves firmly planted, good-by to any more orders for this country."

The Kistna, in the Madras presidency, is crossed by a cable swung between supports 5,070 ft. apart, and one has just been put in China 4,648 ft. in span. The whole weight of the suspended portions is only 6½ tons, and the breaking resistance 70 tons.

THE GREAT ROLLING MILL OF THE ST. JACQUES WORKS.

The preparation of metal melted in great masses in the Bessemer converter or Siemens furnace was the starting point of a complete transformation in the ancient metallurgy of iron. Such transformation has had its consequences in every branch of human activity, and to such an extent that in many respects it justifies the denomination of the new age, or the age of iron as compared with the age of steel, which is often applied at the present epoch to distinguish it from past epochs. We shall not examine here the numerous modifications that the use of this new metal has introduced into the industries of every nature; but, in dealing exclusively with the question of the elaboration of large masses, we shall recall the fact that the power of tools has had to be continually increased to keep pace with the dimensions of the ingots upon which they operate, and the 110,000 lb. pieces that the metallurgy of steel is now capable of producing evidently require other apparatus than the simple tilt hammers which sufficed for the spongy blooms of a thousand pounds that were formerly obtained upon the bottom of the puddling furnace.

The steam hammer, invented about 1841 by Boudon and Nasmyth, was, as may be seen, the principal cause of the wonderful extension that metallurgy has taken since that epoch. It was for a long time justly considered as the emblem of the work of elaboration of iron, the apparatus *par excellence*, the characteristic and pride of large forges; and, in fact, the spectacle that it offers in forges, in the center of the vast halls that have had to be heightened to receive it, never lacks a certain grandeur. It is really the center of all the activity that directs it, and it alone animates the halls which it fills with its strange sonorousness, and whose floor it shakes while it is kneading the bloom of iron with its powerful hands.

We do not desire to put a slight upon the glorious role and the important part that the steam hammer has taken in the progress of French metallurgy, but let it be permitted us to recall that, in the opinion of numerous experienced metallurgists, this machine, whose action is necessarily simple, is not always the one best adapted to the elaboration of great masses, and that in certain cases it may be preferable to have recourse to apparatus whose action is more continuous and effective, such as the rolling mill, and especially the forge press. It is because the steam hammer, which is particularly well adapted for blooms of puddled iron, which it is capable of freeing from their scoriæ, can no longer act the same upon ingots of cast steel which do not possess the same impurities. Its action, which is always abrupt, is necessarily superficial with large ingots; the external surface alone is drawn out, the heat of the mass not being reached, and the metal being badly forged in the center. When a semi-liquid is abruptly acted upon, the molecules, as correctly remarked by the Messrs. Casolanga, flow rather than draw closer upon concentrating. To this, add the internal tensions that often develop in the mass of the ingot under the abrupt impact of the hammer, and that may sometimes cause the apparently spontaneous breakage of the piece. As may be seen, there are here important considerations that well show how metallurgists come to-day to prefer tools whose silent action, exerted continuously, appears of a nature to penetrate more intimately the piece to be worked, and, in a word, to exert itself in the heart of the piece.

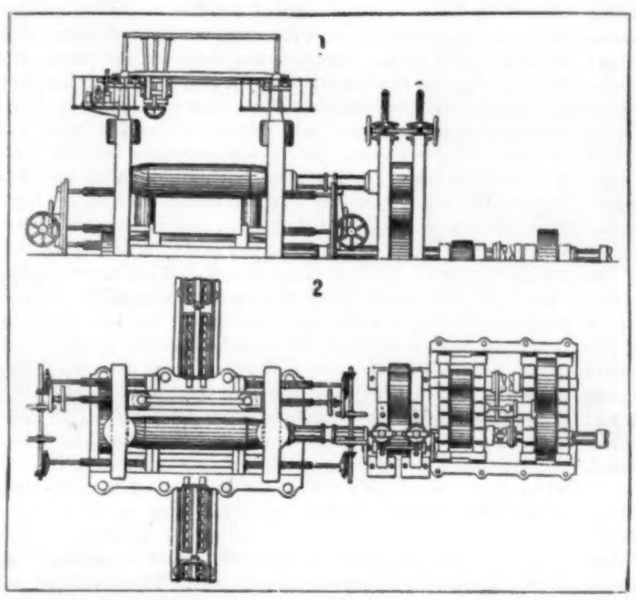


Fig. 1.—ELEVATION AND PLAN OF THE ST. JACQUES ROLLING MILL.

Considered from this standpoint, the forge press may be regarded as the machine of the future, and, alongside of this, the rolling mill, which through the velocity and diameter of its cylinders is allied to the two rival apparatus, and which is assuming a greater and greater importance in the elaboration of those large masses of steel whose complete homogeneousness it is desired to secure.

In Figs. 1 and 2, we represent *one* of the most powerful if not *the* most powerful of plate rolling mills, that of the St. Jacques works, belonging to the Company of Forges of Chatillon-Commentry. The cylinders are 3·28 feet in diameter at the table and 19 feet in length, with a total weight of 55,000 lb. each. They are capable of rolling fagots 4 feet in thickness, and, after certain modifications now making are finished, they will be capable of rolling fagots 5 feet in thickness. The cheeks in which they are mounted are 14 feet apart and are 15 feet in height. They are fixed upon one bed plate in common and are firmly cross-braced.

The lower cylinder, which rises scarcely above the level of the floor, is stationary, the upper one alone being movable, and being mounted in collars that are capable of sliding vertically in the frame guides. This cylinder and its collars are balanced by counterpieces arranged under the bed plate, and the preponderant action of which tends continually to raise the upper cylinder, this movement, moreover, being regulated by the action of pressure screws that traverse the frame.

The upper cylinder is capable of receiving an inclined position with respect to the lower one, so as to permit of the rolling of plates of decreasing thickness, of trapezoidal form, like those now used for the girdles of armor-clad ships. In order to obtain this oblique motion without forcing the collars in their guides, the latter are provided internally with spherical bearings that receive the journals of the cylinders, and thus allow them every liberty to oscillate.

The pressure screws that serve to control the position of the movable cylinder carry at the upper extremity a cylindrical piece upon which is mounted a helicoidal wheel actuated by an endless screw which thus causes its rotary motion. These screws are themselves actuated by a steam engine with two oscillating cylinders, arranged upon a platform as shown in the figure. A special gearing arrangement permits of acting upon both screws together or separately, so as to displace the two collars respectively in their guides to the necessary extent to incline or right the movable cylinder on the horizon. A special pendular system, arranged upon a traverse connecting the extremity of the two pressure screws, at once indicates the corresponding inclination of the cylinder.

In front of the train are arranged vertical cylinders which may be brought together or separated at will by the action of horizontal screws, according to the width of the piece to be rolled. They are designed to press upon the ingot in the direction of its width, so as to prevent the exaggerated sliding of the superficial parts and the hollowing of the edges, and to maintain a more uniform pressure throughout the entire mass. These vertical rollers are 18 inches in diameter and 4¼ feet in length. Their rotary motion is obtained by means of bevel wheels keyed upon their lower journal, and which are themselves actuated by a train of gear wheels mounted upon the axis of the lower cylinder.

The larger horizontal cylinders receive their motion

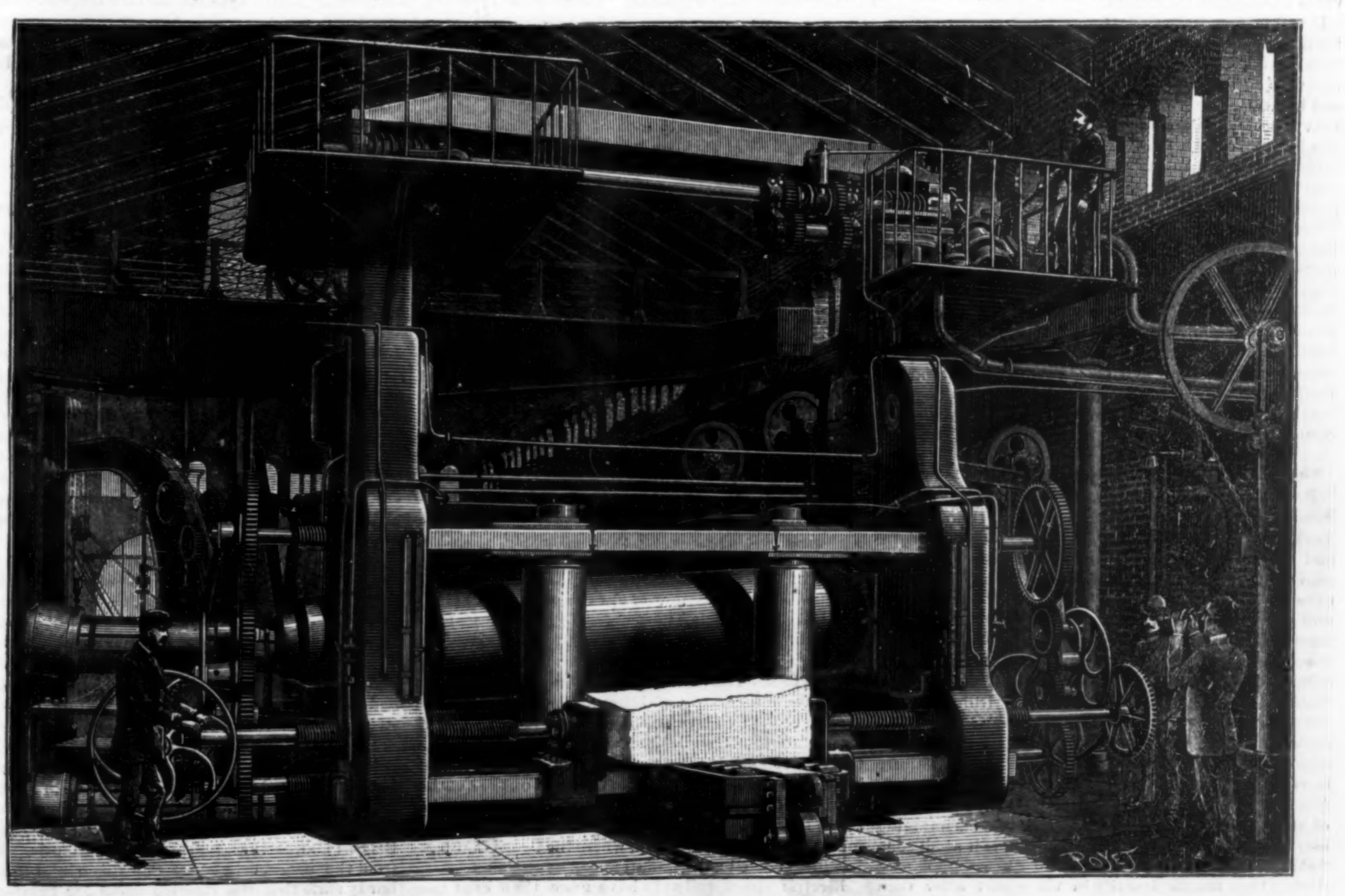


Fig. 2.—THE GREAT ROLLING MILL OF THE ST. JACQUES WORKS.

from the engine through the intermedium of a special rack arrangement. This latter comprises two cast iron uprights, between which are arranged the pinions serving to connect the axis of the movable cylinder with that of the lower fixed one. The pinions, moreover, are attached to the corresponding cylinders by lengthening pieces. As the distance apart of the two cylinders varies at every step, the lengthening pieces of the movable cylinder necessarily take an inclined position, which has the evident inconvenience of an irregular rotary velocity, causing sliding and shocks capable of producing breakages in the rolling. This inconvenience is overcome, to some extent, by changing the pinions when the inclination of the lengthening pieces becomes too great, and this makes it necessary to have two sets of pinions corresponding to the principal thicknesses that are had in view; but the patented arrangement now being introduced at the works is the only one that furnishes a perfect solution of this difficulty. The pinion of the movable cylinder is always controlled by that of the fixed one, but through the intermedium of two interposed pinions, one of which has a fixed axis and the other moves like a satellite around the first. The upper pinion, always controlled by the latter, is capable of moving freely in a vertical direction to an extent regulatable at will by means of an endless screw, and it always remains thus in the axis of the movable cylinder, whose connecting piece has no longer need of any inclination on the horizon. Under such conditions, the dimensions of the frame pieces will permit of varying the distance apart of the cylinders between limits that have never hitherto been attained, say from ½ an inch to 6½ feet.

The St. Jacques apparatus is reversible; that is to say, it rolls alternately in each direction, this being rendered necessary in order that the huge pieces that pass between the cylinders may not have to be carried back unnecessarily to the same side. The reversing gear is interposed between the pinion arrangement and the motor. It consists of two cages, one with one pinion and the other with three pinions of equal diameter. These are put alternately in play, according as it is desired to cause a rotation of the cylinders in one direction or the other. The pinions are thrown into and out of gear by means of clutches controlled by the rod of the pistons of a hydraulic cylinder, which is itself actuated by a pedal placed within reach of the workman.

On each side of the train are arranged tables at right angles with the axes of the cylinders. These carry two rows of rollers, upon which rest the pieces to be rolled. Between these are arranged two iron slides to which a to and fro motion can be communicated by means of a hydraulic cylinder placed under the floor of the works. The motion of the slide is obtained at will by a boy acting upon a lever that causes a hydraulic pressure in the cylinder. The plate is carried along in the motion by hooks that the workman engages to this effect in one of the holes of the row with which the slide is provided throughout its length.

It will be seen from this that the backward and forward motion is, as it were, effected mechanically. Five men and two boys, in fact, suffice to effect the rolling of ingots whose weight may exceed 110,000 lb., and it is certainly a most curious spectacle to see such heavy incandescent masses as this obeying an irresistible impulse to pass and repass docilely between the cylinders that crush them, and to see these cylinders stop rotating after the passage of the plate, in order to resume their operation at once in the opposite direction.

Fig. 2 shows the passage of a trapezoidal plate through the mill. The various workmen are at their posts, and to the right is seen the foreman examining the plate with a pyrometric telescope. This most remarkable instrument, the invention of two engineers of the St. Jacques works, permits of accurately determining the temperature of a mass or of a furnace heated red hot, and is destined to render the greatest services in every industry in which there is need of regulating the high temperatures employed.—*La Nature.*

The Unsanitary Condition of Country Homes.

Dr. Lucy M. Hall, who recently lectured before the Academy of Anthropology, in Cooper Union, New York, on "Sanitation in the Country," told some plain and wholesome truths on the subject. She has, it appears, given this matter close attention, has examined over 150 country houses, both East and West, and gave the audience her opinion—that the average farm house is not the healthful place that it is supposed to be by the people who pour out of the crowded cities in the summer time. On the contrary, she has found that disease and death lurked within many a vineclad and moss-covered cottage, because simple hygienic laws were violated. Some of the evils she referred to were improper drainage, uncemented cellars, failure to ventilate sleeping apartments, exclusion of light, too much shade about the house, and the improper disposal of kitchen refuse. The prospect is not an encouraging one for "summer birds of passage," nor is it at all comforting to think that the seeds of disease implanted during the summer fructify in the winter after their return home.

The Advances in Electricity in 1888.

When we contrast the present state of electric science and industry with their condition a year ago, we are struck with the remarkable advances that have been made, especially in the latter. The most important experiments bearing on the theory of electricity have been those of Hertz on the propagation of electrical disturbances, with investigations by various workers on the effect of light on various electrical phenomena. Hertz has obtained electric oscillations of a very short period—several hundred millions in a second—and he has shown that electro-magnet waves caused by them are propagated in the surrounding space, and are reflected and interfere with one another as do waves of light. To those who have not believed the electro-magnetic theory of light, these experiments will be of great importance. For those who have believed the theory, they will add corroborative and strengthening evidence. Our general views of the electric current have been gradually changing, and the idea of the energy of the current being transmitted through the surrounding dielectric, and entering the wire at every point, is changing our methods of treating problems of current propagation and our conceptions as to the mechanical reality that underlies the phenomenon. A number of experiments on the discharge of condensers have been made, notably by Professor Lodge, with a view of developing a theory of lightning and of providing the best means of guarding against lightning strokes. There grew out of Professor Lodge's experiments a warm discussion before the British Association, on lightning conductors, in which there was shown a wide difference of opinion between "theoretical" and "practical" men as to the best means of protection against lightning, and the interest aroused promises to be the means of adding largely to our knowledge on the subject. The development of the alternating system of electric lighting has stimulated investigations in that direction, and a number of experiments on self and mutual induction, on induction coils, etc., have been made.

In the application of electricity the advance has been much more striking, especially in this country. In lighting, the increase in the number of lights has been steady and rapid; and, although no radical improvements nor fundamental discoveries have been made, yet the efficiency of all of the lighting systems has been increased, and the expense reduced. In arc lighting there have been only changes in detail of the important systems; but the number of new stations being equipped, and that have started in the last year, greatly exceeds the showing made in 1887. Incandescent lighting has progressed still more rapidly. The Edison company has erected central stations of large capacity—up to a maximum of 50,000 lamps—in New York, Philadelphia, Chicago, and other cities, besides adding to the already long list of small stations. They have increased the efficiency of their incandescent lamps, and have perfected their dynamos. The returns of stations using this system have been for the year most satisfactory, and it is stated in some of the technical papers that a large amount of capital—no less than ten million dollars—has been subscribed abroad for the extension of the system.

The number of electric motors that have been supplied from central stations has also largely increased. The Westinghouse Company has continued to distribute electricity by the alternating system, and has rivaled the increase of the older Edison company. The advantages of their system for distributing to scattered points, and even in cities where overhead wires are allowed, and where the lights are not concentrated in a particular neighborhood—the lighting of stores, halls, theaters, etc.—are apparent. The efficiency of their converters and lamps has been increased, and experiments are being carried on with a view to perfecting some motor that can be used on alternating circuits. Other companies are doing a great deal of business in a quiet way in putting in private installations for factories, offices, etc. There has been much rivalry in electric lighting, and three of the most important companies—the Edison, the Westinghouse, and the Thomson-Houston—are at swords' points, and much of the current technical literature consists of discussions as to the merits and demerits of the various systems.

But it is in the extension of power distribution by means of electricity that the year has been most memorable. Large numbers of electric motors have been installed for supplying powers from one-tenth to forty or fifty horse power, and these are fed from the local lighting companies, and have displaced small steam and gas engines. The uses to which they have been applied are innumerable, and they are increasing in favor as their economy and efficiency become more apparent. More ambitious installations have been carried out in the Western mining districts, the most noteworthy being the power plants at Aspen, Col., and on the Feather River in California, where the Sprague Company has transmitted power (in the last case a distance of nine miles), and at Virginia City, where the Brush Company has just effected an installation.

Electric street railways have more than kept pace with stationary motor work. The first large road equipped was the Richmond road of the Sprague company, the largest and most difficult installation that had ever been attempted. After numerous disappointments, and after overcoming difficulties that would have disheartened any less energetic and efficient company, the road was successfully opened in March, and has been running without interruption ever since. There is little doubt that to the success of this tramway is due the boom in electric motor cars, that has given the Sprague and other companies a business even greater than their large capacity. The Sprague company has finished or is equipping thirty street railways, the Thomson-Houston company as many more, while the Daft company has under way or finished a dozen or fifteen. All of these roads have overhead wires to convey the current from the dynamos to the motors. It is probable that the ultimate system of street car traction will be by storage batteries on the car, supplying current to motors beneath them, geared to the axles. During the year there has been little progress in this system of traction. One or two cars are being run in New York, in Philadelphia, and in some of the Western cities. The progress has hardly, however, been satisfactory. The present type of storage cell is heavy and inefficient, and rapidly deteriorates; and the year has not seen the introduction, either here or abroad, of any new type of battery nor any marked improvement in the old. For exceptionally favorable roads, where there are very light grades, storage battery cars will cost about the same as horses, or perhaps a little less; but there are few such in the States.

No important inventions in industrial electricity have been developed during the year, although several very promising ones have been patented and are being improved and tested. The Tesla motor for alternating currents is being developed by the Westinghouse company; several plans for continuous current conversion are being experimented on; new types of storage battery have been described, and will possibly prove successful.

Nothing important has been done in the telephone line. In telegraphy, Professor Gray has developed a writing telegraph, which will possibly do what is claimed for it, but which seems very complicated.

There has been much patent litigation, and important decisions have been rendered here and abroad. In an English suit, Edison's fundamental patent on carbon filaments for incandescent lamps was badly damaged, although the decision has been appealed from, and it is again being tried. The patents of the Westinghouse company for the alternating system have been decided against, both in England and this country. The Supreme Court has decided that the government has the right to bring suit against the Bell Telephone Company to annul Bell's patent, but this decision is of interest only as establishing the general right of the government to bring such a suit. A number of important suits are pending on patents for storage batteries, incandescent lamps, systems of distribution, etc.; and after the holidays a case before the Supreme Court will decide whether Edison's fundamental patents on electric lighting have expired with the limit of the foreign patents.

On the whole, the year has been one of solid advance and improvement, but with no startling development nor revolutionary discovery.—*Science.*

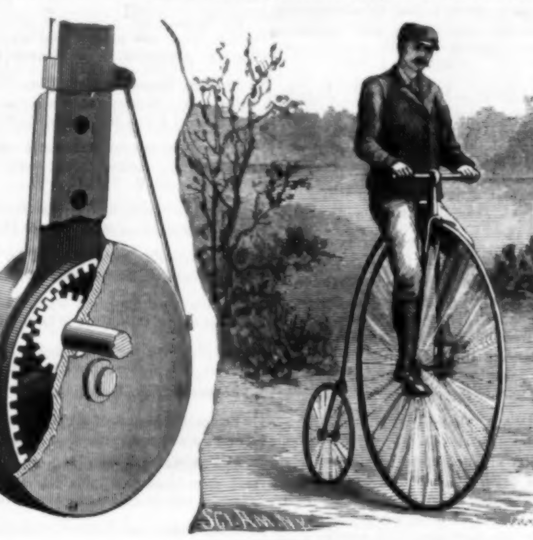
Testing Telegraph Poles.

A young man with a gimlet two feet long stopped in front of a telegraph pole in an uptown street the other day and began to bore into it. Another young man, a reporter on the New York *Sun*, stopped also and asked the first what he was about. "I am going to find out how long this stick will stand up," he said, twisting the handle rapidly. "I am employed by the company that owns the pole, and it is my business to go about the streets making inspections like this. Every pole is numbered, and when I make my report the company takes action according to the condition of the wood. This is the only way we can tell how strong a pole is, for decay begins beneath the surface and works toward the center. It shows on the outside last. So you can't tell from the looks whether a pole may not come down in the first high wind, or light one, either, for that matter. This one," and he withdrew his gimlet and looked at the fine shavings clinging to it, "will last at least a year without danger. There is one on the Bowery, near Fourth Street, that looks perfectly sound, much better than this one, in fact, and yet it is decayed almost from surface to surface, and is liable to fall any day." The young man did not know when the company would replace the dangerous pole, and, after making a memorandum in a book, he proceeded up the street to probe the next stick.

A REPORT from Elba states that the whole of the island is infected by phylloxera. In Toscana the efforts to check the plague have as yet proved unsuccessful. The insect has also made its appearance at Parmi, in Calabria, at Novara, and at Cervo in Liguria. Reports from the neighborhood of San Remo and from Lombardy state that the infected areas are constantly increasing.

AN IMPROVED BICYCLE.

The accompanying illustration represents a bicycle having internal gear by means of which, from the pressure of the feet on the pedals, greatly increased speed is obtained over that to be had with an ordinary crank wheel of the same diameter. It has been patented by Messrs. Wilber W. and Horace Spencer, of Piqua, Ohio. The fork of the bicycle, which is secured to the spindle of the wheel, has rigidly fixed thereon a casting, in the center of which is the bearing of an internal gear crown wheel meshing with a spur wheel fixed to the spindle of the bicycle wheel, the crank being connected to the spindle of the crown wheel. The casting can be readily attached or removed, and its connecting parts greatly strengthen the portions of the vehicle where the greatest strain comes, while a removable cap or cover serves to protect the operating parts.



SPENCER'S BICYCLE.

CHESLEY HEAL, THE CENTENARIAN.

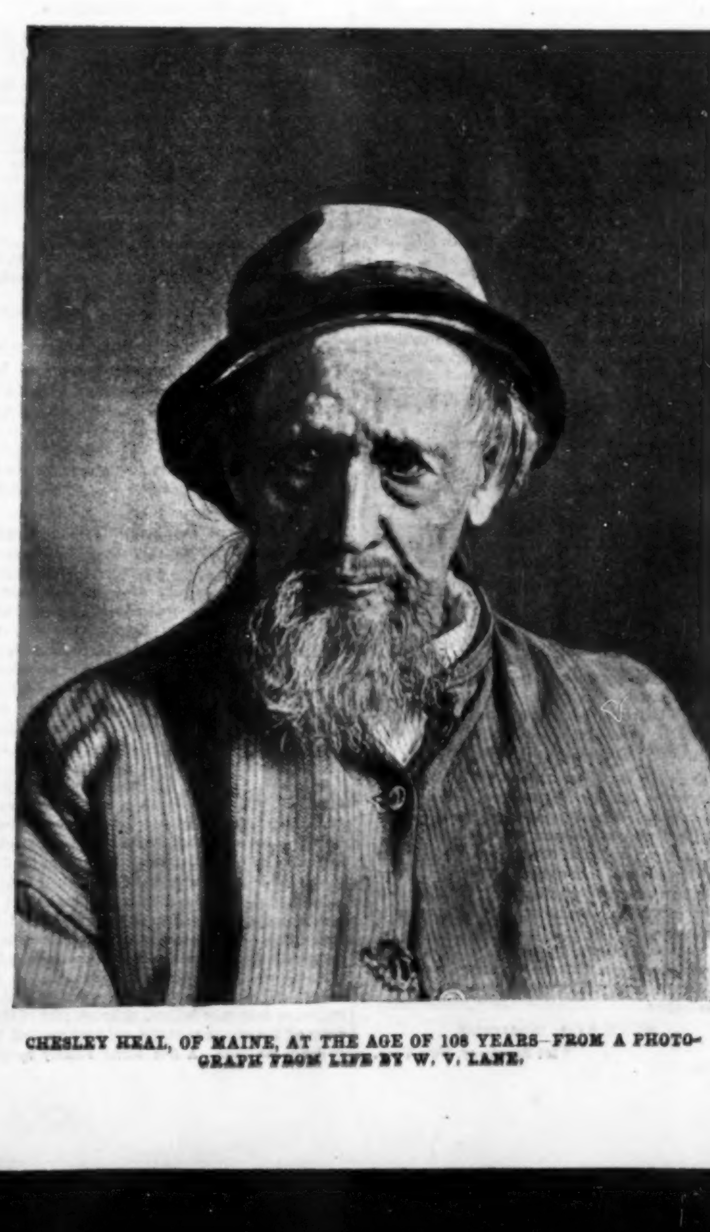
From time to time we have published accounts of wonderful cases of longevity, and the subject of this sketch deserves a high place in our gallery of centenarians. Chesley Heal was born at Westport, Me., on November 16, 1778, and died at Searsmont, Me., October 6, 1888, nearly completing the almost unprecedented term of 110 years. Of his father's family not much is known. His mother came from England at the age of 14 years, and he had three brothers and one sister. He was married twice, and had four sons and one daughter by his first wife, none by his second. His son Isaac died during the rebellion, another died at home, another was lost on a whaling voyage, and the remaining son is still living. There are fourteen grandchildren and fourteen great-grandchildren, all living. The early part of Heal's career was a very active one. He was a soldier in the war of 1812, and served in the division stationed along the coast of Maine at Lincolnville, Northport, and Belfast. He was at Belfast when the British forces, under Major-General Gasselin, crossed the Penobscot Bay from Castine and captured the town. The English force consisted of 700 picked men, of almost equal height, who had served under Wellington. The small American regiment was unable to cope with this force, and no opposition was offered to the landing of the troops. Owing to this fact, the British commander gave orders that the people should not be molested, and that all provisions should be paid for, which was accordingly done.

In 1823, Heal purchased a farm of several hundred acres, at Searsmont, near Belfast. He determined upon clearing and developing this land, and turned all his energies to that end. He took great interest in raising cattle, and his farm was usually in a good state of cultivation. He was very frugal, very industrious, almost parsimonious in his style of living, and as he was considered a successful farmer, it was anticipated that during so long a life his accumulations would be considerable, but at his decease very little was discovered, and what has become of his wealth nobody knows. Some suspect that he buried his money, and as he never confided it to any one, his secret died with him.

He took quite an active interest in politics, and was a staunch Democrat, having voted at every election from 1800 to 1880. His first vote was cast for Thomas Jefferson. Possibly his absolutely quiet life had something to do with his longevity. He rarely left his own neighborhood, and never, it is said, traveled on a steamer or on a railroad train. He never saw anything of the turmoil and bustle of the world, and his nerves were never disturbed. He was quite unlettered, being unable to read or write. He kept his accounts by peculiar marks on his barn door, which he alone understood. His memory was highly cultivated, owing to the constant calls made upon it on account of his being unable to read and write, and this aided him in keeping his accounts.

Physically, he was well proportioned and strongly built. He was five feet eight inches in height, and weighed normally about 175 lb. He had a full, well developed chest. He was a great talker, and had a loud voice. His health was so perfect that during his whole life he was only once visited by a physician until his last illness. His eyesight and hearing continued unimpaired until the end. His hair did not turn gray until he had experienced the frosts of a hundred winters. He was a remarkably good sleeper, retiring usually at sunset and rising at dawn. He was a good eater, living on fresh meat during the autumn and early winter when the farmers were slaughtering, but during the summer his diet was principally salt pork cut into slices and fried. The bread on his table was made from wheat, rye, corn, barley, and buckwheat from his own farm. He used tobacco nearly his whole life. He preferred to chew rather than smoke the weed. When young he was addicted to the use of spirituous liquors. He never had any mental labor of any kind, nor any care or worry. A curious feature of his life is that at the age of 105 he concluded to remain in-doors, and although being quite strong and active in his movements he did not leave the house during the last five years of his life. He did not use a cane, and at times was as active as a boy. He said he could move about the country as well as ever, and would give no reason for his voluntary seclusion. He retained his faculties to the end, and died quietly, and was buried in a field in his own farm.

It is interesting for a moment to look at the remarkable changes that have taken place during the lifetime of a single human being. Heal was born in the midst of the revolutionary war, and was nearly three years old when the surrender of Cornwallis marked the close of the struggle. He was in his nineteenth year when Washington retired from the presidency, and during his life all the presidents were nominated to their high offices. He was nearly fifteen when Louis XVI. was beheaded and the Reign of Terror began. He had entered on his twentieth year when Napoleon was made First Consul, and was 26 years old when he was elected Emperor. It was in his thirty-seventh year that the great commander was defeated at Waterloo. He lived during the period of the three French revolutions. During his life France had been three times a kingdom, three times an empire, and three times a republic. He was a boy in his teens when Robert Burns was composing his lyrics, when Burke was thundering in the House of Commons, and when Sir Joshua Reynolds was giving the world his great works of art. He was 28 when Fulton launched the first regular steamboat, and 66 when Morse first brought the telegraph into practical use by sending messages between Washington and Baltimore. It is almost impossible to conceive that a single life can span such epochs in history. A much fuller account, by Rev. George E. Tufts, of which this is an abstract, will be published in an early issue of the SCIENTIFIC AMERICAN SUPPLEMENT.



CHESLEY HEAL, OF MAINE, AT THE AGE OF 108 YEARS—FROM A PHOTOGRAPH FROM LIFE BY W. V. LANE.

The Gases Occluded in Coal.

At the November meeting of the Newcastle section of the Society of Chemical Industry, the vice-chairman (Professor P. P. Bedson) gave a short account of some experiments on the gases occluded in coal, a paper on which subject he had read before the North of England Institute of Mining and Mechanical Engineers He stated that some time ago a member of the Institute drew his attention to the remarkable behavior of a particular class of coal dust at one of the collieries under his superintendence; and suggested that it would be desirable to ascertain whether this particular coal dust contained gases inclosed in it, as coal itself does. The author said that the investigations of Herr Von Meyer in Germany, and of Mr. W. J. Thomas in this country, have demonstrated that coal holds varying amounts of gases inclosed in it—the gases consisting of mixtures of carbon dioxide, nitrogen, oxygen, and marsh gas (CH_4); and in some few instances other hydrocarbons related to marsh gas and olefiant gas (C_2H_4) have been found in the gases obtained from the coal. The gases inclosed in the coal were obtained by placing it in suitable vessels and exhausting them by a Sprengel pump, and at the same time heating the coal at 212° Fah., drawing off the released gases by the continual flow of mercury.

An account was then given by the author of the results obtained by submitting coal dust collected fresh from the screens to a similar process. The coal dust was found to contain, like coal itself, gases occluded or inclosed in it, and in considerable volume. The analyses of these gases indicated a general resemblance in composition to those obtained by Von Meyer and Thomas, and further that the combustible portion of the gases consisted in all probability in part of hydrocarbons related to olefiant gas (C_2H_4) and of members of the series to which marsh gas belongs, similar to those forming the natural gas issuing from petroleum wells. A portion of the dust had been examined, by exhausting it successively at temperatures of 50°, 70°, and 100° C., at each of which temperatures gas was given off which was separately collected and analyzed. The results tended to show a kind of fractionation of the paraffine hydrocarbons contained in the dust, the value of n in the formula C_nH_{2n+2} being greater at the higher temperature. He added that, as a coal dust from one source only had been examined, it would be premature to draw any general conclusions from the results obtained; but it is the author's intention to submit coal dusts and coals from different sources to a similar examination. Should further investigations confirm the results obtained, the existence of gases inclosed in coal dust, together with the nature of the combustible portions of these gases, will, it is thought, aid in some measure to explain the influence of coal dust in colliery explosions.

From the report of the proceedings at the meeting as published in the society's own *Journal*, it appears that in the discussion that took place at the close of the paper, Mr. Pattinson and Mr. Gatheral suggested that the loss of occluded gas by keeping might account for the lessened inflammability and the deterioration of coal kept for some time. Dr. Bedson said that this change was chiefly due to the oxidation of the coal, and that the amount of occluded gases was too small to noticeably affect the quality of the coal by their loss.

FISH may be scaled easier by first dipping them in boiling water for a minute.

RECENTLY PATENTED INVENTIONS.

Agricultural.

SULKY PLOW. — George W. Haines, Stockton, Cal. The frame of this machine has a vertically adjustable transverse shaft, with a rocking support, permitting adjustments of the plow beams and plows, without interfering with the free action of the clevis, with other novel features, adapting the plow to a wide range of work in preparing lands to receive crops, for road grading, and other purposes.

BAND CUTTING FORK.—Arthur Rodman, Holder, Ill. This is a fork with a blade or cutter attachment, whereby, in unfastening sheaves of grain, preparatory to shaking, before the straw is passed through the thrashing machine, the man using the fork can cut the bands and handle the straw simultaneously, expediting the work and saving the service of extra help.

CORN HARVESTER AND HUSKER.—Andrew L. Rasmuson, Clermont, Iowa. This invention covers novel features of construction and combinations of parts in a combined corn harvester and husker, by which corn may be gathered, husked, and passed to a discharge opening, where it may be placed in bags or other receptacles.

POTATO DIGGER. — James W. Scott, Uhrichsville, Ohio. This invention covers an improved construction of an apparatus formerly patented by the same inventor, whereby the machine is made more durable and efficient, having detachable spades or cutters to suit different soils, and to assist sandy or loamy soils, clods, weeds, etc., in passing back on the shaker.

SWIVEL PLOW.—Ferdinand J. Blanke, Whitewater, Wis. This plow is light, simple, and durable, and the invention provides means whereby the plows may be reversed expeditiously and conveniently, while the draught and position of the handles will be simultaneously changed to correspond with the plow brought into use.

Mechanical.

BALING PRESS.—David L. Hannay, Grapeville, N. Y. This press has a cam device for adjusting the yielding wall of the baling box by a slight turn of the cam head lever, with other novel features, making a simple, inexpensive, and efficient machine for pressing hay, straw, cotton, etc., into smooth bales, with economy of time and labor.

CHANNELING MACHINE.—William H. Bryant, North Amherst, Ohio. The machine consists essentially of a jointed drill-carrying lever mounted upon an adjustable fulcrum, the two sections of the lever being normally held in the same plane by a spring, while the lever is connected to a crank shaft adapted to impart a rocking motion, the machine being designed especially for quarry use.

MAKING STEREOTYPE PLATES.—Lucius Goss, Upper Montclair, N. J., and Samuel W. Trew, Brooklyn, N. Y. This invention covers a novel construction of machine for trimming, planing, and sawing the plates, and fitting them for the form by a single passage of the plate through the machine, which has a reciprocating bed plate in combination with edge trimming knives, plane, diagonally set saw, and holding bars.

PRINTING CYLINDER.—William Berri, Brooklyn, N. Y. This cylinder is designed especially for use in the printing of warp threads to be used in the weaving of tapestry carpets, where a number of cylinders and supporting carriages are employed, each cylinder and carriage arranged to print a different color upon the yarn, the invention covering a segmental printing block or die with recessed side faces, and with projections extending from its inner circumferential face.

CALIPERS AND DIVIDERS. — Thomas Green, East Davenport, Iowa. This is an improved measuring and drawing instrument specially adapted for mechanics, and to be used as inside and outside calipers, dividers, etc., the instrument having a plate with segmental graduated part and a fixed arm held thereon, with an indicator, and other novel features, whereby the instrument may be readily changed from a divider into an inside or outside calipers.

NEWSPAPER ADDRESSING MACHINE.—Henry Banks, Jr., La Grange, Ga. This is a machine intended for attachment to the folder of a newspaper press, for addressing the newspapers as they are delivered, and is so constructed that when no papers are passing through the machine the addressed strip is not cut, the invention covering various novel features of construction and arrangement of parts.

Railway Appliances.

RAIL CHAIR AND SLEEPER.—Cenemon P. Espinasse, Montauban, France. This is a metallic railway sleeper having on its upper surface a central longitudinal rib, with parallel side ribs and transverse ribs, the central rib being recessed and notched, in combination with a compressible packing block having a serrated upper surface, and a railway chair having a serrated bottom surface bearing on the packing block.

HEAD CHAIR AND CONNECTING ROD.—William J. Hooper, Rincon, New Mexico. This invention provides a railway head chair and switch connecting rod so constructed as to render the parts strong and durable, while the throw rail connection is so made that if any of the parts become worn or broken they may be easily and quickly replaced.

Miscellaneous.

SHOE HORN. — Samuel D. McKenty, Philadelphia, Pa. This horn is made with a handle, and a lower portion capable of clamping the back end of the shoe and conveniently pulling it on to the foot, without soiling the hands of the wearer.

SKATE.—Thomas H. McQuown, Biggsville, Ill. This skate is made with a sole plate and a runner made in two parts, of which the rear part is rigidly secured to the sole plate, and the front part pivotally connected thereto, permitting the skater to skate on his heel or toe, or on both, and readily pass over uneven ice or obstructions.

HOISTING GEARING. — Carl H. W. Reichel, New York City. This invention covers a differential pulley and cord hoisting gearing more particularly adapted for adjusting the picture or color tray of an artist's easel, six pulleys being journaled to fixed and movable parts of a structure, in combination with an endless cord, the device being also applicable to a wide range of work in connection with other mechanisms.

KNIFE CLEANER.—Robert W. Jamieson, Prince Albert, Saskatchewan, N. W. Territory, Canada. It is made with two blocks or plates hinged together to present opposing faces for first cleaning and then polishing knife blades, the blades to be first cleaned while wet and afterward dry polished, the blocks being faced with cleaning fabric and supplied with knife brick powder.

MAKING BASIC LEAD SALTS.—Farnham M. Lyte, Cotford, Oakhill Road, Putney, Surrey County, England. This invention covers a process of fitting sparingly soluble salts of lead for use as white pigments, by first treating basic lead acetate with sulphuric acid to precipitate the extra base, then rendering the precipitate basic by the addition of basic lead acetate, and finally boiling the mixture.

RUNNING GEAR FOR VEHICLES.—Alfred W. Johnson, New Brunswick, N. J. By this invention king bolts are dispensed with, and certain combinations made between the bodies and swiveling axles of wagons, whereby, when cranking the axles, the center portions thereof in direction of their length are brought closer together or moved further apart, the whole space between the wheels being utilized by sliding the body of the vehicle.

SCIENTIFIC AMERICAN BUILDING EDITION.

FEBRUARY NUMBER.—(No. 40.)

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1. Elegant plate in colors showing elevation in perspective of a suburban club house, with floor plans, sketch of entrance, etc. Munn & Co., architects, New York.
2. Plate in colors showing perspective and plans, with details, for a comfortable country dwelling. Cost three thousand five hundred dollars. Designed by Munn & Co., architects, New York.
3. View of the Jay Gould tomb at Woodlawn cemetery, near New York city. A most classical specimen of mortuary architecture.
4. A residence at Rutherford, N. J. Perspective elevation and floor plans.
5. A Queen Anne cottage at Flatbush, Long Island. Cost complete, eight thousand dollars. Plans and perspective.
6. A carriage house for one thousand dollars, lately built at Flatbush, Long Island. Perspective and floor plan.
7. A house for three thousand dollars lately erected at Bridgeport, Conn. Perspective elevation and floor plans.
8. A residence at Orange, N. J. Cost fourteen thousand dollars. Plans and perspective.
9. A block of eighteen hundred dollar frame dwellings at Syracuse, N. Y. Floor plans and perspective.
10. The Galliera Museum, Paris. Half page engraving.
11. Sketches from the Architectural League Exhibition: Proposed memorial campanile for plaza of Prospect Park, Brooklyn, N. Y., Henry O. Avery, architect—The Washington Hotel, Kansas City, Mo., Bruce Price, architect, N. Y.—Towers of hotel at Big Stone Gap, Va., Brunner & Tryon, architects—District school house at Washington, Conn., Rossiter & Wright, architects.
12. Design for a boat house of moderate cost, by Munn & Co., architects, New York.
13. Page of engravings of country residences.
14. Miscellaneous Contents: Restoration of the Doge's Palace.—The broken timber raft.—Raising columns of St. Isaac's Cathedral, St. Petersburg.—Tarred bricks.—Pompeian houses. — Repairing of a well.—Finish for pine.—Architecture as a profession.—Paintwork.—The National Association of Builders.—How best to light our country homes and resorts, illustrations.—Larch lumber.—The Thomson-Houston motor for street cars.—Hints on plumbing and cellars.—The fatal climate of Panama.—Improved hoist for passenger or freight elevators, illustrated.—Clark's new anti-friction caster, illustrated.—Tool cabinet, illustrated.—Universal bevel protractor, illustrated.—California slate.—Pipe wrench, illustrated.—The "Gorton" boiler, illustrated.

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Minerals sent for examination should be distinctly marked or labeled.

(322) R. J. F. writes: I use a large amount of burlaps to wipe paraffine from tin cans. Will you please inform me in the SCIENTIFIC AMERICAN of a cheap way to save both the paraffine and burlap to use again? A. Wash the burlap in naphtha and distill it after the burlaps are removed, saving the distillate to use again. The paraffine will remain in the retort.

(323) H. E. S. writes: The Amoskeag steam fire engine has always been known as having a submerged flue boiler, the flues carrying off smoke and distributing the heat. I have had a number of arguments upon this boiler, it being claimed that while it was a flue boiler, it was a tubular boiler also. I hold that it is a flue boiler and not a tubular boiler, in the sense that a fire engine boiler is tubular nowadays, for you find by consulting the make of boiler used on all modern engines, such as Clapp & Jones, Ahrens, Lafrance, Silsby, that the water is carried inside the tubes, the heat outside, and the whole boiler interior being the smoke flue. I cannot furnish you cuts to illustrate my position, but perhaps you are familiar with them. The flues in an Amoskeag boiler are certainly tubes before they enter into the construction of the boiler, but after that they carry off the smoke and distribute the heat and furnish the draught for fire, and I hold are no longer tubes, but flues. Am I right in my understanding as to the tubular and flue boiler? A. In the pipe trade, tubes and flues are names used for the same article. The custom with boiler makers is to designate all boilers made with the small welded tubes or flues, whether vertical or horizontal, as tubular boilers, and the boilers with drop tubes, as used in fire engine, as drop tube boilers, although part of the tubes carry off the smoke as in the ordinary vertical tubular boiler of the trade. A flue boiler strictly speaking is applied to that class of boilers having large riveted flues. In the present advanced state of the wrought iron pipe industry, these large flues are now made by welding the same, and are generally called flues.

(324) Lecturer and Draughtsman asks us to explain the principle on which the megascope is constructed, which throws an image on the screen from opaque or surface objects, instead of from transparencies. Also, could the principle be adapted to throwing an image in a dark room from external objects, and what size of disk can be thrown? A. For illustrated description of an electric megascope see SCIENTIFIC AMERICAN SUPPLEMENT, No. 640. It is suitable for illustrating lectures and oral teaching. When adapted for projecting outside objects in a dark room, it becomes a camera, or, in connection with a mirror, on the principle of the solar microscope, may have its optical center changed in the direction of outside objects. The size of the image may be from 4 to 10 feet diameter or more, according to the intensity of the light and size of lenses. They can be procured through the optical trade.

(325) E. C. H. O. asks: Will an optical expert kindly say if a concave mirror can reproduce external objects in a dark box or room like the camera obscura, and would the image obtained be strong enough to affect a sensitized surface? A. About forty-five years ago Prof. John W. Draper and Mr. Wolcott made experiments with concave reflectors for taking daguerreotypes, some of the reflectors having holes at the center for observation and elimination of stray light. Aberration and other difficulties caused them to be laid aside and superseded by the fast improving lenses for photographic work. 2. Also, what instrument is there for giving representations of external objects, so as to sketch them, besides the camera lucida? A. We know of nothing but the camera obscura in its various forms, and nothing is better than a good camera lucida if properly shaded.

(326) C. A. M. says: Please inform me through your columns how to stain Tennessee poplar wood a nice cherry color with a good finish. Also what acid I can use to clean brass by dipping? A. For cherry color, mix equal parts of solution of extract of logwood and solution of saffron in dilute spirit of wine, and add a little solution of tin to tone the stain; dry and varnish. To clean brass by acid dip, make the brass clean from all grease or varnish by dipping in a hot strong solution of potash and rinse in hot water, then dip in strong nitric acid for a few seconds and then in hot water. If the color is not clear at first, dip again.

(327) Amateur Binder says: I would like a receipt for making a varnish for the leather covers on books. Something to use on roan binding to finish up with. I used an alcohol varnish, and it made the color run. A. Use bookbinder's varnish, which is made by dissolving pale gum sandarac 3 ounces to 1 pint 95 per cent alcohol, dissolve cold and decant. Apply very quickly with a small soft sponge, like wiping the surface lightly. It is the excess in quantity that makes the color run.

(328) B. F. E. asks: 1. What should constitute a solder (such as is used on tin cans, oyster, peach, and other preserves) which would be durable, and at the same time so that the tin soldered with it could be easily pulled apart? A. There is no solder that will pull apart easily that is reliable; 50 parts tin, 25 parts lead, 25 parts bismuth, make an easy flowing solder that is weaker than the ordinary tinman's solder. 2. What is the cost of tin cans? A. We cannot furnish cost of tin cans.

Enquiries to be Answered.

The following enquiries have been sent in by some of our subscribers, and doubtless others of our readers will take pleasure in answering them. The *number* of the enquiry should head the reply.

(329) D. Y. M. asks: What substance will change hard water to soft?

(330) S. T. R. says: I will be pleased to have you inform me or tell me where I can find out the results of the trials that have been made in burning steam by blowing it into boiler furnaces, or in any other way. Is it actually burnt, and if so what are the economic results, and at what temperature does it ignite?

(331) J. F. asks: Can you inform me through your answers to correspondents, the mode of constructing the arch of the West Shore tunnel at West Point and the means used?

(332) W. A. T. says: I want to descend from a balloon by means of a parachute; what kind of goods can I make a hot air balloon and parachute of without using silk, and how large must balloon be to carry 250 pounds, and what is the best way to fill the balloon with hot air?

(333) E. L. asks: Will you kindly inform me how to stop new shoes making so much noise?

(334) W. L. G. asks: 1. Will you please inform me what is the best method for mounting starch granules and blood corpuscles for microscope objects? 2. A mounting medium that will not dissolve raphides. 3. What is the highest magnifying power of the large Lick telescope?

(335) L. W. S. asks: 1. What is the cause of cyclones? 2. Why did we have no cyclones forty or fifty years ago?

(336) E. W. T. asks: Please give me a formula for making gold lacquer that will stand 250 degrees of heat without cracking off, and that will not come off when applied upon tin if it is run through a machine and bent in any direction.

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the numbers therein given:

(81) Mixing Chemicals: — In mixing nitrate of potash with sulphur and sulphide of antimony care should be exercised to avoid explosion or deflagration. Powder each ingredient separately in a clean mortar and mix without using the pestle.

(88) Volts required to operate an electric motor one-half the size of one described in SUPPLEMENT, No. 641. Six volts and upward, if the battery is of low resistance.

(89) Wire for Induction Coil.—Use No. 36 on secondary, No. 20 on primary. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 160 and 569. A No. 2 Grenet battery is large enough to work it, though two or three cells would be better.

(92) Silver Plating.—The battery described is large enough. For oxidizing copper and brass. For brass 4 drachms perchloride of iron to 10 oz. tersulphide of arsenic, 1 pint water. For copper, 1 drachm sulphur, 1 oz. pearlash, 1 pint water. Immerse until the color is satisfactory in depth. Quicking articles before plating is not absolutely necessary, but is to be recommended.

(125) Staining Ivory.—Treat with pyrogallic acid to make nitrate of silver stain permanent.

(127) Producing Green and Blue Stains. —The science of staining minerals has received quite extensive development of late, chalcedony and other minerals proving particularly amenable to the treatment. The mineral salts are used; the exact treatment seems hard to ascertain.

(133) Converting Carbonic Oxide (CO) into Carbonic Acid Gas (CO_2).—Pass it through a tube containing oxide of copper heated to a full red heat.

(137) Cost of Induction Coil in SUPPLEMENT, No. 161.—Copper Color of Aniline Green.—The materials for induction coil will cost from $10 to $15. Labor you must estimate for yourself. The copper color you refer to is not due to copper; the aniline contains none; it is a kind of fluorescence.

(138) Strength of Batteries.—Batteries for Various Uses.—Dynamo and Motor.—1. Disque Leclanche, E. M. F. 1·48 volts, resistance one ohm. 2. Do not know what battery you mean. 3. Fuller and Bunsen, E. M. F. 1·8 to 2·0 volts, resistance 1-10 to 1 ohm, according to size. From above you can calculate amperage, dividing E. M. F. by battery resistance, plus outer circuit resistance. The proper voltage of battery depends on the uses. No general rule can be given. Low resistance of battery is the great desideratum. Use gray iron for motor and dynamo castings. No data as to current given by motor used as dynamo.

(142) Converting Chloride of Silver into Nitrate of Silver.—Place in a flask with metallic zinc; treat with dilute sulphuric acid, adding zinc or acid as required until the chloride is completely reduced to the metallic state. Remove any zinc, wash thoroughly, first with dilute sulphuric acid and finally with hot water, and dissolve in nitric acid. Evaporate to dryness and fuse at a low heat. This gives lunar caustic or fused nitrate that can be subsequently dissolved in pure water.

(142) G. O.—Reduction of Silver Chloride.—Melt your chloride of silver with freshly burnt lime 1 part and chloride of silver 4 parts. After which dissolve the result (which will be pure silver) in nitric acid and evaporate to dryness, wash the same several times and evaporate to dryness after each washing. The result will be pure nitrate of silver.—C. H. M.

(142) To Obtain Pure Silver Nitrate from Pure Silver Chloride.—The silver chloride is first reduced to metallic state, which is best done as follows: The precipitate is dried and mixed with nearly an equal portion of a mixture of sodium and potassium carbonates, put into a crucible, a little borax added and fused. After complete fusion, pour the contents of crucible into some suitable receptacle, and when cool the silver globule is easily separated from the mass. The metallic silver is then dissolved in as small a portion as possible of nitric acid heated; diluted with an even amount of distilled water and evaporated to dryness. To the dried mass add distilled water, heat till dissolved, and set aside. Crystals of pure silver nitrate will form.—EDMUND WRIGHT, Jr., Philadelphia, Pa.

(143) Using Motor as Dynamo.—Advise you to make a regular dynamo, such as described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 600.

(144) H. W. C.—Artificial Cold Room.—One freezing mixture without ice consists of equal parts nitrate of ammonia and water; another, of equal parts nitrate of ammonia, carbonate of soda, and water. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 605, 578, 443, 314, 288, 254, 215, for illustrated descriptions of various methods of producing cold.

(145) Running Coffee Mill.—It needs about 1-16 horse power. A ⅛ horse power battery with motor should run it. The belt is large enough.

(146) F. McD.—Ebony Finish on Counter.—We doubt the possibility of your being able to make a satisfactory ebony finish on a Georgia pine counter. The sap pores would take a dye by absorption, but the resin veins would not take a permanent color and would show the resin streak through the varnish.

(147) F. D.—Stamping Powder.—Use pulverized steatite, or French chalk.

(148) W. L. W.—The diaphragm should be placed between the lenses, so as to revolve, with holes of various sizes to suit the requirements of sensitiveness in the plates, as shown in the exterior view of the camera. 2. It is doubtful if a 75 cent reading glass would give you satisfaction as an enlarging lens.

(149) J. I.—Horse Tread Power.—The circular horse power, if well constructed, will have less friction than the common treadmill. The treadmill is, on the other hand, easiest on the horse, as the walk is on a straight line.

(150) J. E. E.—Old Boilers.—There are a few boilers of the cylindrical type that have been in use more than 34 years. We do not recommend the use of a locomotive boiler of great age. The day of reckoning may come too soon.

(151) J. A. W.—Varnish for Canvas Boats.—Use a varnish made by dissolving pure rubber gum in naphtha. Paraffin applied hot to the perfectly dry boat is also excellent.

(152) P. F. B.—Crude Oil for Stoves.—Experiments have been made in the direction of using crude petroleum for household heating and cooking, without satisfactory results. The odor and its volatile constituents seem to be a drawback. There is a wide field of invention yet left in this line.

(153) J. A.—Salt in Cement Mortar.—See SCIENTIFIC AMERICAN, January 7, 1888.

(154) W. H. W.—Cleaning Castings, etc.—Immerse the castings in a bath of hot water 10 parts, sulphuric acid 1 part, from one to two hours, and wash in hot water to remove acid, or smear the castings with a stronger solution 1 part sulphuric acid and 4 parts water, after three or four hours wash in hot water. 2. There is no fear of the steel ball valve sticking by magnetism enough to affect its work. Otherwise we know of nothing better than hard bronze for the ball, say 4 oz. tin to 1 pound of copper. 3. Make the moulding trough of 2 inch plank and bind it with iron.

(155) W. W. Y.—Circular Saws.—It is possible to use three saws in cutting large logs. Mills with three circular saws are in use in California and Washington Territory. Band saws are superseding the double circulars to a large extent, as there is less friction and less heat for the amount of work done.

(156) G. A. C.—Acoustics of a Hall.—Your question is too indefinite for special answer. Consult Saltzer's "Treatise on Acoustics."

(157) W. McV.—Boilers and Engine.—The boiler with 3 inch tubes is the best for wood fuel, and otherwise the most durable. The difference in favor of the automatic cut-off over the throttle valve regulation may amount to 10 or 12 per cent.

(169) F. W. M.—Blue Checked Cotton. —The dye probably had not been fixed by a mordant, or the check may not have been properly printed and dressed to fix the printing. If not, this may also be the cause of so much shrinkage.

(170) O. I. F.—How to Cut and Polish Stones; Dynamo.—You will need a thin copper disk about 6 in. diameter made to revolve rapidly on a spindle. With No. 90 to 100 emery and water liberally fed to the wheel, you will be able to slab any specimens of rocks or minerals of ordinary hardness. You will also need a grindstone to flatten the surfaces for polishing. A lap of lead is used with fine emery, and another of wood faced with leather or felt fed with a cream of rouge and water. The laps should run at a speed of 150 and may be 10 or 12 in. diameter, the specimens being held on their face with the hand. For a less expensive arrangement for surfacing only a good grindstone and a piece of sole leather nailed to a board, with the whole manipulation made by hand, will make satisfactory work with amteurs. For a more detailed description of lapidary work, see a work by Byrne, "Artisan, Mechanic and Engineer," $5, which we can mail. 2. It depends on the voltage desired. Use wire to give the same number of turns on the armature, and use two numbers larger on the field.

(171) T. H. F.—Walnut Stain.—Mix equal parts of solution of extract of logwood and solution of saffron, dilute with spirit of wine, add some solution of tin in hydrochloric acid. For a variety of acid, water sulphide and gallate of iron stains, see "Techno-Chemical Receipt Book," $2, which we can mail.

(173) J. A. B.—Hydraulic Pump Gaskets. —Make hydraulic pump gaskets of sole leather only. They should be cupped in a mould made to size of pump. For speeding machinery or other computations, see Mechanics', Millwrights', and Engineers' Pocket Book, by Templeton.

(174) Steam Boiler.—1. Divide the area of heating surface, in square feet, by 16, and the quotient will be the horse power required. 2. Feed pipes should not burst quicker in front of a boiler than behind. They are, however, more liable to burst, or "give out," when exposed to the fire than when not so exposed.—W. J. B.

(179) C. L. S. inquires how to make a porous brick to use as a fire kindler. Take three fifths fire clay, one-fifth coarse ground brick, pea size, and one-fifth sawdust. Bake in a kiln and the sawdust will burn away, leaving a porous brick.—D. Y. M.

(185) Hot Air Furnace.—Your rooms are evidently not properly ventilated. Each room, to heat economically, should have, near the floor, on the side of the room opposite the register, a ventilator, connected with suitable flue for carrying off cold air which settles to the bottom of the room. Make hot air pipes as short as possible, and run them on as sharp an incline as possible. Cold air should be taken direct from outside, and from the windward side of the house, so that if any wind is blowing it will force the warm air into the rooms. Care should be taken to arrange the cold air inlet so that the wind will not blow by it, forming a partial vacuum and causing back draught.—W. J. B.

(185) C. H. S.—Hot Air Furnace.—There may be several causes for the deficiency of your furnace: 1. The doors and windows of the rooms may permit the wind to blow through. If so, the draught will prevent the rising of warm air unless it is pretty well forced. 2. The pipes may not have rise enough from the furnace to the outlets, and last, but not least, the air box may not be large enough to supply the furnace, or may not be in the right place. The air box must have three-fourths the capacity of the hot air pipes, and should face north or west. The end of the box should be protected from any wind that may draw air from the furnace instead of supplying it (an atomizer will illustrate what I mean), for without a sufficient cold air supply you cannot get warm air. If C. H. S. will send an addressed envelope to A. H. Woodruff, 478 Mulberry Street, Newark, N. J., I will send a diagram of a simple means of automatically preventing the siphoning of the furnace through the air box.—A. H. W.

(189) Magnetized Watch.—Means of putting in order a watch that has been magnetized by a dynamo are described in vol. iv., No. 14, of the SCIENTIFIC AMERICAN, under the heading of "The Demagnetization of Watches." No solution is known which will have the desired effect.—W. J. B.

☞ Books or other publications referred to above can, in most cases, be promptly obtained through the SCIENTIFIC AMERICAN office, Munn & Co., 361 Broadway, New York.

NEW BOOKS AND PUBLICATIONS.

PHOTO-ENGRAVING, ETCHING, AND LITHOGRAPHY. By W. T. Wilkinson. Revised and enlarged by Edward L. Wilson. New York: Edward L. Wilson. Price $3.00.

This book gives practical directions for photo-engraving in line, in half tone, and on copper, photo-lithography in line and in half tone, and also of the collotype and heliotype processes. The two authors show a familiarity in detail with most of the experiments which have had a modicum of success during the past twenty years, during which so much effort has been made to supersede the old methods of engraving by the use of photography, and the book cannot fail to be of use to all who do such work, while to a beginner it will be almost invaluable.

CHEMICAL LECTURE NOTES. Lectures of Professor C. O. Curtman. By Prof. H. M. Whelpley. St. Louis, Mo.: Published by the author. Pp. 211.

This is the second edition, revised and enlarged, the notes being made from lectures delivered at the St. Louis College of Pharmacy. The publication is designed more particularly to meet the wants of students of pharmaceutical and medical colleges.

THE PRACTICE OF MEDICINE MADE PLAIN. By Dr. C. D. Bobo. Oakland, Cal.: Pacific Press Publishing House. Pp. 148.

This is a work devoid of technicalities and scientific phrases, in which the author endeavors to set forth, in concise form, the results of his own practice, and his methods of treating a wide variety of cases, during an experience of forty-five years.

☞ Any of the above books may be purchased through this office. Send for new book catalogue just published.

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Hose clamp, O. Thum 396,625
Hose coupling, J. Coghlan 396,684
Hose coupling, J. D. Sloan 396,435
Hydraulic engine, H. G. T. Glazebrook 396,556
Ice box pan, C. W. Smith 396,619
Ice cream box, J. Van Dyk 396,443
Indicator. See Street and station indicator.
Ink bottle and attachment therefor, N. Johnson 396,496
Ironing table, shirt, J. H. Mount 396,416
Joint. See Furniture joint.
Knife cleaner, R. W. Jamieson 396,492
Knitting machine, circular, E. Lippitt 396,578
Knob attachment, door, Iddings & Megeath 396,571
Ladder, fire extension, H. T. Hayes 396,564, 396,565
Lamp socket, incandescent, O. P. Loomis 396,583
Lamps, lanterns, etc., indicator for, W. A. Chase 396,540
Lathe carriage, W. Lodge 396,700
Life saving net, M. Hunter 396,491
Limekiln, oil burning, Clark & Mapel 396,541
Lock. See Nut lock.
Lock, H. Van Hoevenbergh 396,628
Lock nuts, manufacture of, Goodwin & How 396,477
Loom positive shuttle motion, C. F. Wickwire 396,522
Lubricator, W. M. Derby 396,471
Lug chair, two-part self-locking, W. McLain 396,590
Lumber, machine for grooving, J. T. Graybowski 396,599
Macaroni and noodles, machine for making, C. Heid 396,567
Marine vehicle, W. Henry 396,486
Mattress, wire, O. Howe 396,605
Meter. See Electric meter. Time meter.
Milking machine, cow, J. J. Lefeber 396,577
Mill. See Crushing and grinding mill. Grinding mill. Triturating mill.
Mining machine, A. E. Watkins 396,719
Mop wringer, F. R. Smith 396,436
Nut lock, G. H. Griffin 396,691
Nuts on bolts, machine for fitting, F. Philipps 396,597
Oil burner, J. Bains 396,525
Oils or other liquids, oxidizing, G. B. Wiggin 396,636
Opera glass, G. Holle 396,657
Oven, baker's, F. Duhrkop 396,395
Packing, metallic, Westbrook & Cook 396,634
Pad. Sed Bosom pad.
Padlock, A. Peterson 396,596
Paints from oil foots, making, G. W. Scollay 396,432
Pan. See Dust pan. Ice box pan.
Paper box, F. G. Hotchkiss 396,570
Paper hangers, folding table for the use of, G. H. Bryson 396,531
Paper roll, toilet or wrapping, S. Wheeler 396,675
Paper waxing machine, Hodkinson & Raymond 396,402
Paper weight, A. E. Swift 396,519
Pen, fountain, S. A. De Normanville 396,547
Photographic apparatus, automatic, Pope & Poole 396,428
Photographic plates, magazine plate holder for, F. A. Hetherington 396,656
Photographic shutter, E. Kuhn 396,609
Pianos, device for muting, J. Keller 396,698
Picture exhibitor, automatic, C. Bach 396,455
Pipe coupling, Dill & Rote 396,550
Pipes, apparatus for moulding, W. A. Palmer 396,506
Pipes, joint for soft metal, W. A. Henderson 396,654
Planing machine, J. A. Saucier 396,513
Planter, corn, S. Huffman 396,490
Plow, T. W. Shunk 396,434
Plow, edging, J. S. Stevens 396,714
Plow handle, S. I. Allen 396,394
Plow, sulky, G. W. Haines 396,480
Plow, swivel, F. J. Blanke 396,460
Plow, wheel, H. H. Satér 396,606
Plows, revolving mould board for, C. Gaylord 396,397
Post holder, W. B. Thomas 396,624
Potato digger, J. W. Scott 396,433
Press. See Baling press. Cheese press.
Printers' inking rollers, composition for, J. D. Baylis 396,387
Printing cylinder, W. Berri 396,390
Printing machine, rotary, J. Michaud 396,532
Printing machines, inking apparatus for, W. Scott 396,612
Printing presses, gripper for platen, R. Mingay, Jr. 396,502
Propelling ships, mechanism for, J. Stenard, Sr. 396,672
Pulley and cord hoisting gearing, differential, C. H. W. Reichel 396,430
Pulley, split, W. A. Willingham 396,637
Pump, A. H. Nixon 396,504
Pump operating mechanism, O. Henjum 396,495
Pump, sand or mud, Mead & Magee 396,501
Quilling machines, stop motion for, D. Ashley 396,384
Rail chair and sleeper, combined, C. P. Espinasse 396,473
Railway structure, cable, W. H. Young 396,638
Railway switch, W. H. Barwick 396,679
Railway switch, C. W. Walker 396,629
Railway switch and signal, H. F. Parsons 396,419
Railway switch, automatic, A. I. Parsons 396,418
Railway system, electric, D. G. Weems 396,633
Railway trolley and support, electric, S. H. Short 396,618
Railways, automatic block signaling system and apparatus for, H. F. Parsons 396,421
Railways, continuous rail frog for, H. F. Parsons 396,420
Rrailways, turntable for cable or electric, W. Davidson 396,649
Reel. See Fishing reel.
Refractory compounds, producing, J. L. Hastings 396,658
Ring for curtain poles, J. Rings 396,604
Roof slates, fastening for, O. W. Nurcross 396,593
Roofing, metallic, L. L. Sagendorph 396,686
Roving frame, etc., S. Tweedale 396,718
Rubber dam clamp, W. G. Browne 396,597
Ruler, draughting, W. F. Heilig 396,568
Safe and copying press, combined, T. S. Spivey 396,670
Safe lining, W. W. Booth 396,660
Salts, making basic lead, F. M. Lyte 396,703
Sash fastener, F. A. Bascom 396,386
Sash fastener, C. H. Dexter 396,548
Sash holder, L. Pflngst 396,709
Saw gauge, adjustable, W. V. Prince 396,696
Saw gin, R. S. Munger 396,706
Saw set, Lewis & Sener 396,666
Scale, weighing, T. H. Herndon 396,569
Scraper, L. R. Carhart 396,647
Selling machine, automatic, J. W. Vaughn 396,674
Separator. See Garlic separator.
Sewing machine feeding mechanism, S. W. Wardwell, Jr. 396,630
Sewing machine shuttle, S. W. Wardwell, Jr. 396,631
Shoe horn, S. D. McKenty 396,411
Shutter bower, J. J. Taylor 396,442
Sign plate, D. Macdonald 396,704
Skate, T. H. McQuown 396,413
Smoke, spark, and cinder arrester, W. B. Johnson 396,697
Snarling machine, W. McPherson 396,412
Soda, recovering, C. F. Dahl 396,546
Sounder attachment, Carey & McArthur 396,465
Spade, ditching, J. E. Ketcham *et al.* 396,650
Spinning frames, etc., clearer for removing waste, etc., from the top of, W. E. Sharples 396,616
Spring. See Vehicle spring. Wagon spring.
Square, tailor's and dressmaker's, P. Fant 396,396
Stand. See Flower stand.
Stay, garment, M. P. Bray 396,533
Steam boiler, W. Cowles 396,545
Steam engine, Westinghouse & Rites 396,635
Steam heater, H. Sperl 396,438
Steam muffler, W. E. Pearson 396,507
Stencil, W. F. McKay 396,410
Stereotype plates, machine for trimming, planing, and sawing, Goss & Trew 396,478
Stove, gas, L. Ketchum 396,575, 396,576
Street or station indicator, W. F. Seeley 396,613
Stud or other jewelry, A. Luthy 396,661
Sulphur compound, E. Baumann 396,386
Swill receptacle, J. W. Hall 396,401
Switch. See Electrical switch. Railway switch. Time switch.
Table. See Ironing table.
Tablet cover, writing, W. B. Pearson 396,508
Tag fastener, C. Schoolherr 396,610
Tax receipt blank, Harrison & Howard 396,560
Telegraph system, municipal, T. J. Zoeller 396,450
Telegraphic purposes, dynamo for, Gmur & Flatz 396,557
Telephone, mechanical, T. S. & W. W. Davis 396,688
Textile fabrics, machine for piling, O. Wolfsohn 396,720
Ticket, railway, W. A. Megrath 396,591
Tile machine, C. Carr 396,466
Time meter, electric, G. F. Card 396,645
Time switch, B. E. Waters 396,632
Tongue tip for vehicles, W. Chatterson 396,683
Triturating mill, J. R. Alsing 396,453
Trough. See Feed trough. Watering trough.
Truck, sleigh, L. R. Carhart 396,646
Truss, J. R. Meloney 396,414
Truss for torsion balances and the like, W. Kent 396,497
Tube boiler, radial, Clarke & Savage 396,393
Typewriter ciphograph, G. Bofinger 396,529
Typewriting machine, Currier & Blount 396,686
Valve and trap, check, C. K. Moore 396,505
Valve, steam-actuated, A. Ball 396,643
Vehicle running gear, A. W. Johnson 396,494
Vehicle spring, R. Sproul 396,671
Vehicle, two-wheeled, A. A. Abbott 396,640
Vehicle wheel, J. Bolick 396,461
Vehicle wheel, Schaus & Mayer 396,514
Velocipede pedal, E. E. Tufts 396,673
Vessels, construction of, J. D. Cornwall 396,648
Violin tail piece, R. A. Macready 396,408
Wagon spring, C. A. Howard 396,694
Warp linking machine, R. Garsed *et al.* 396,554
Washer. See Dish washer.
Washing machine, C. D. La Port 396,498
Water closet, S. F. Sniffen 396,628
Water elevator, automatic compressed air, J. K. Leedy 396,465
Watering trough, stock, T. A. Perry 396,596
Waterproofing compound, C. T. Snedekor 396,622
Web feeding mechanism, L. C. Crowell 396,470
Weighing machine, coin-controlled, W. S. Davenport 396,394
Wells, rig for drilling and pumping, G. Corbett 396,544
Wheat for food, preparing, R. Smith 396,621
Wheel. See Fifth wheel. Vehicle wheel.
Whiffletree, F. R. Willison, Sr 396,676
Windmill, D. J. Howenstine 396,489
Window opener and closer, A. Rapp 396,599
Window shades, maps, etc., exhibitor for, E. A. Bullard 396,463
Wire drawing machine, H. Smith 396,437
Wire tightener, C. B. Butler 396,682
Wrench, A. L. Duncan 396,689
Wringer. See Mop wringer.

DESIGNS.

Bottle, therapeutic, E. C. Post 18,879
Photograph exhibitor case body, Porteous & Miller .... 18,876 to 18,878
Trunk, P. Carpeles 18,875
Trunk tops, corner iron for, P. Carpeles 18,874

TRADE MARKS.

Ale, mixture or compound for making ginger, M. Michaelis & Son 16,210
Baking powder, G. C. Hanford 16,208
Baking powder, K. B. Sayres 16,215
Belting, medium grade rubber, New York Belting and Packing Company 16,211
Boots, shoes, and slippers, F. Daisimer 16,199
Cologne, B. Kent 16,208
Cutlery, Graef & Schmidt 16,202
Flour, wheaten grits, farina, oatmeal, cornmeal, and hominy, St. Paul Roller Mill Company 16,218
Food substances, oleaginous, N. K. Fairbank & Company 16,201
Leather for the uppers of shoes, C. S. Hull 16,205
Maize or Indian corn, C. E. Prunty 16,213
Meats, preserved, Cunningham & De Fourier Company 16,198
Medicine for internal use, cough, B. T. Jacobs 16,207
Ointments, cuticle, Boiling Drug Company 16,197
Paper and envelopes, writing, B. A. Hard 16,204
Paper, writing, Riverside Paper Company 16,214
Remedy for abrasions and other external injuries and diseases of the skin, liquid, E. B. Waldo 16,219
Shoes, Elderkin Taylor Company 16,200
Sirup and sugar, L. F. Palmer 16,212
Tea, Japan, H. J. Hunt 16,206
Tea, Japan, Smith, Baker & Co., of Japan 16,216
Tonic and stimulant, nerve, B. Kent 16,209
Woven fabric, cotton or partly cotton and wool and partly wool, Smith, Hogg & Gardner 16,217

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